EXHIBIT 9

UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA

GOOGLE LLC, *Plaintiff*, v. SONOS, INC., *Defendant*.	Case No. 3:20-cv-6754 Case No. 3:21-cv-7559

EXPERT REPORT OF DOUGLAS C. SCHMIDT ON CLAIM CONSTRUCTION

I. SCOPE OF ASSIGNMENT

1. While this case was in the District Court for the Western District of Texas, I submitted two Declarations relating to the following claim terms found in U.S. Patent Nos. 9,967,615 ("'615 Patent") or 10,779,033 ("'033 Patent"):

Patent	Term
'033 Patent	"data network"
'615 Patent	"local area network"
'615 Patent	"a media particular playback system"
'033 Patent	"wherein the instruction comprises an instruction"

2. With respect to the '615 Patent, I understand that Sonos is currently asserting claims 13-15, 18-21, and 25-26 against Google. With respect to the '033 Patent, I understand that Sonos is currently asserting claims 1-2, 4, 9, 11-13, and 16 against Google.

3. In this Report, I have been asked by Sonos to provide my opinions on how a person of ordinary skill in the art ("POSITA") at the time of the inventions of the '615 and '033 Patents would have understood the following claim terms:

- "playback queue"

- "resource locators"

4. This Report explains my analysis and opinions of the above-identified claim terms that are used in the '615 and/or '033 Patents. In forming my opinions, I have read and understand the claims of the '615 and '033 Patents, their common specification, and their respective file histories.

5. I reserve the right to supplement or clarify the opinions set forth herein, and if I am requested to do so, to provide additional opinions regarding the '615 and/or '033 Patents.

6. I am being compensated at my normal hourly consulting rate of $550/hour for this matter. My compensation does not depend in any way on the nature of my opinions or the outcome of this case.

7. The following lists the materials I considered in forming the opinions set forth herein:

- '615 Patent
- '615 File History
- '033 Patent
- '033 File History
- Google's Preliminary Claim Constructions and Evidence Pursuant to Patent Local Rule 4-2
- US Patent 8,032,612 ("Tosey") (SONOS-SVG2-00043035)
- US Patent 8,386,495 ("Sandler") (SONOS-SVG2-00043078)
- US Patent 8,533,469 ("Song") (SONOS-SVG2-00043153)
- US Patent App. Publ. 2010/0235469 ("Morris") (SONOS-SVG2-00043131)
- US Patent App. Publ. 2011/0004330 ("Rothkopf") (SONOS-SVG2-00042964)
- US Patent App. Publ. 2012/0089910 ("Cassidy") (SONOS-SVG2-00042982)
- US Patent App. Publ. 2014/0075308 ("Sanders") (SONOS-SVG2-00043004)

II. SUMMARY OF OPINIONS

8. As explained in detail below, it is my opinion that Google's proposed constructions (set forth in the chart below) do not properly reflect a POSITA's understanding of these claim terms in the context of the '615 and/or '033 Patents as of the time of the invention.

Patent	Term	Google's Proposed Construction
'615 Patent '033 Patent	"playback queue"	"An ordered list of multimedia items that is selected by the user for playback"
'615 Patent	"resource locators"	"Address of a resource on the Internet"

9. I understand that Sonos and/or Google may seek construction of claim terms in the '615 and/or '033 Patents other than those expressly addressed herein. Other than the terms addressed herein and the terms that I addressed in my Declarations submitted while this case was in the District Court for the Western District of Texas, I have not analyzed, and express no opinions on, the proper construction of any other claim term in the '615 or '033 Patent at this time.

III. BACKGROUND & QUALIFICATIONS

10. I am the Cornelius Vanderbilt Professor of Engineering in the Department of Electrical Engineering and Computer Science at Vanderbilt University in Nashville, TN, where I also serve as the Associate Provost for Research Development and Technologies and the co-Director of the Data Science Institute. My research spans a broad range of software systems, including distributed object computing, middleware platforms, real-time operating systems, and distributed real-time and embedded systems. I became a Full Professor with tenure at Vanderbilt University in January 2003.

11. I received my Doctor of Philosophy (Ph.D.) degree in Computer Science from the University of California (UC) Irvine in Irvine, CA in 1994. I also earned a Master's Degree in Computer Science from UC Irvine in 1990, as well as a Bachelor's Degree in Sociology in 1984

and Master's Degree in Sociology in 1986 from the College of William and Mary in Williamsburg, VA. I first started programming in 1983 when I was an undergraduate student taking statistics courses. From 1985 through 1994 I learned how to program in Pascal, C, C++, Ada, Prolog, and Lisp, both at the College of William and Mary and at UC Irvine.

12. I have been a full-time university professor since 1994. I was previously a tenured professor at the University of California, Irvine in the Electrical and Computer Engineering department, from 2000 to 2003, and before that at Washington University in St. Louis, MO in the Computer Science and Engineering department and the Mallinckrodt Institute of Radiology, from 1994 to 1999. In addition, I served as the Chief Technology Officer and Deputy Director for the Software Engineering Institute (SEI) at Carnegie Mellon University from 2010 to 2012, where I led the SEI's research, development, and operational efforts related to software engineering and cyber-security.

13. For the past three decades, my research has focused on distributed real-time and embedded (DRE) systems, which has yielded the ACE, Java ACE, TAO, and CIAO middleware frameworks. The millions of lines of object-oriented code in these frameworks provide layers of infrastructure and distribution middleware that simplify the development of concurrent and networked software apps and services. These middleware frameworks constitute some of the most successful examples of software research and development (R&D) ever transitioned from research to industry, being widely used by thousands of companies and agencies worldwide in many domains, including national defense and homeland security, datacom/telecom, financial services, healthcare, and online gaming.

14. My research on DRE systems has been funded by various organizations, including both federal agencies, such as DARPA, NSF, NASA, NIH, the U.S. Air Force, and the U.S.

Navy, as well as leading companies, such as Northrup Grumman, Raytheon, Lockheed-Martin, Boeing, McDonnell-Douglas, General Electric, Siemens Medical Engineering, and Kodak Health Imaging Systems. I have also received other honors and awards, including election to professional organizations, engagements for invited talks, and the 2015 Award for Excellence in Teaching from the Vanderbilt University Department of Electrical Engineering.

15. Besides my academic and research experience, from 2010 to 2014, I served as a member of the United States Air Force Scientific Advisory Board (SAB), where I was the Vice Chair of the SAB's Cyber Situational Awareness study, which conducted a comprehensive review of the U.S. Air Force's tactics, techniques, and procedures related to secure network-centric mission operations. I have also served on the Advisory Board for the U.S. Naval Air Systems Command (NavAir) Future Airborne Capability Environment (FACE) and was a co-lead of a task force on "Published Open Interfaces and Standards" for the U.S. Navy's Open Systems Architecture initiative.

16. For over 30 years, I have conducted and supervised many research projects involving a wide range of software-related topics, including patterns, optimization techniques, and empirical analyses of communication protocol stacks, web servers, and object-oriented middleware frameworks for distributed real-time embedded systems and mobile-/web-based cloud computing applications. I have published 650+ scholarly articles and technical papers, and I am the co-author/editor of 10+ books or book-length manuscripts on various topics, including software architecture, network programming, object-oriented frameworks, distributed and real-time systems, open-source middleware platforms, and web-/mobile-based cloud computing applications.

17. My work has been cited 45,000+ times across a comprehensive spectrum of high-impact publications, and my current h-index[1] score is 88, which reveals the significant impact of my publications on scholarly literature in the field of computer science. I have also supervised the research of more than 40 PhD and Master's graduate students to date. Together with conducting and publishing my own research, I have served on the editorial board of many journals, including publications by IEEE and the ACM, and I have been a guest editor of many special issue journals based on my research expertise.

18. On top of my research experience, I have decades of hands-on programming experience with a variety of different programming languages. I began programming with C in 1985 and have programmed with object-oriented languages since 1986, when I began to program with C++. I have programmed with Java and other related object-oriented languages since the mid-1990s and early 2000s. Starting in 1991, while at the University of California Irvine, I led the development of one of the first C++ object-oriented frameworks for concurrent and networked middleware and applications (ACE). Starting in 1996, I developed one of the first Java object-oriented frameworks for concurrent and networked middleware and applications (Java ACE).

19. Since 1990, I have taught more than 2,500 students in dozens of face-to-face courses on network programming to both undergraduate and graduate students at UC Irvine, Washington University St. Louis, and Vanderbilt University. Since 2013, I have taught mobile cloud computing to more than 400,000 students in online courses, including Massive Open Online Courses (MOOCs) on the Coursera platform, which have focused on technologies like

[1] The h-index is a popular measure of scholarly productivity. The definition of the index is that a scholar with an index of h has published h papers each of which has been cited in other papers at least h times. Thus, the h-index reflects both the number of publications and the number of citations per publication.

mobile app programming with Android, Java, and JavaScript, as well as programming cloud computing platforms using various web services frameworks, such as Spring and Node.js.

20. Together with my regular course offerings, over the past 30 years I have also taught 600+ short-courses and tutorials on many subjects, including: software design patterns, object-oriented and functional programming; systems programming and network programming for UNIX and Windows; multi-threading and synchronization; concurrent and parallel programming; and various courses on distributed systems, real-time and embedded systems, TCP/IP, web apps and services, compiler construction, algorithms, and data structures.

21. My complete qualifications and professional experiences are described in my curriculum vitae, provided as Appendix A.

IV. LEGAL STANDARDS

22. I am not an attorney, but I have been informed by counsel about legal standards relevant to my opinions.

23. I understand that claim construction begins with the language of the claims themselves. Claim terms are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art ("POSITA") when viewing the claim terms in the context of the entire patent.

24. I understand that, in some cases, the plain and ordinary meaning of a claim term may be readily apparent and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.

25. I understand that, in other cases, a claim term may have a specialized meaning in which case it is often necessary to look to the intrinsic evidence—which I understand to include the claims, the specification, and the prosecution/file history of the patent at issue—to construe

the claim term. Indeed, I understand that the context in which a term is used in a claim can be highly instructive. I also understand that the specification is highly relevant to claim construction and can be the single best guide in determining the meaning of a claim term. In this respect, I understand that a claim construction that stays true to the claim language and most naturally aligns with the specification will be the correct construction.

26. I understand that an inventor is typically entitled to the full scope of his/her claimed invention. In this respect, I understand that it is improper to limit the scope of the claims to a preferred embodiment described in the specification or add limitations into the claims that are not required by the intrinsic evidence. I also understand that claims are interpreted with an eye toward giving effect to all terms in the claims and thus, claims should be interpreted so that no claim term becomes meaningless, nonsensical, or superfluous.

27. Moreover, I understand that extrinsic evidence – dictionaries, treatises, and the like – can also be used to assist with claim construction. However, I understand that intrinsic evidence is often more reliable than the extrinsic evidence.

V. LEVEL OF ORDINARY SKILL IN THE ART

28. In my Declarations submitted while this case was in the District Court for the Western District of Texas, I provided my opinion regarding the level of ordinary skill in the art with respect to the ’615 and ’033 Patent.

29. As a recap, I assessed the ’615 and ’033 Patents and their file histories and considered the type of problems encountered in the art, the prior solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the level of education of active workers in the field, as well as my own experience. And based on my assessment and my personal knowledge and experience in the fields of networking and audio

and/or video systems, I concluded that a person of ordinary skill in the art for purposes of the '615 and '033 Patents is a person having the equivalent of a four-year degree from an accredited institution (typically denoted as a B.S. degree) in computer science, computer engineering, electrical engineering, or an equivalent thereof, and approximately 2-4 years of professional experience in the fields of networking and network-based systems or applications, such as consumer audio systems, or an equivalent level of skill, knowledge, and experience.

30. In forming the opinions set forth herein, I applied the level of ordinary skill in the art set forth above. However, my opinions would remain the same even if the level of ordinary skill were slightly different.

VI. OVERVIEW OF THE '615 & '033 PATENTS

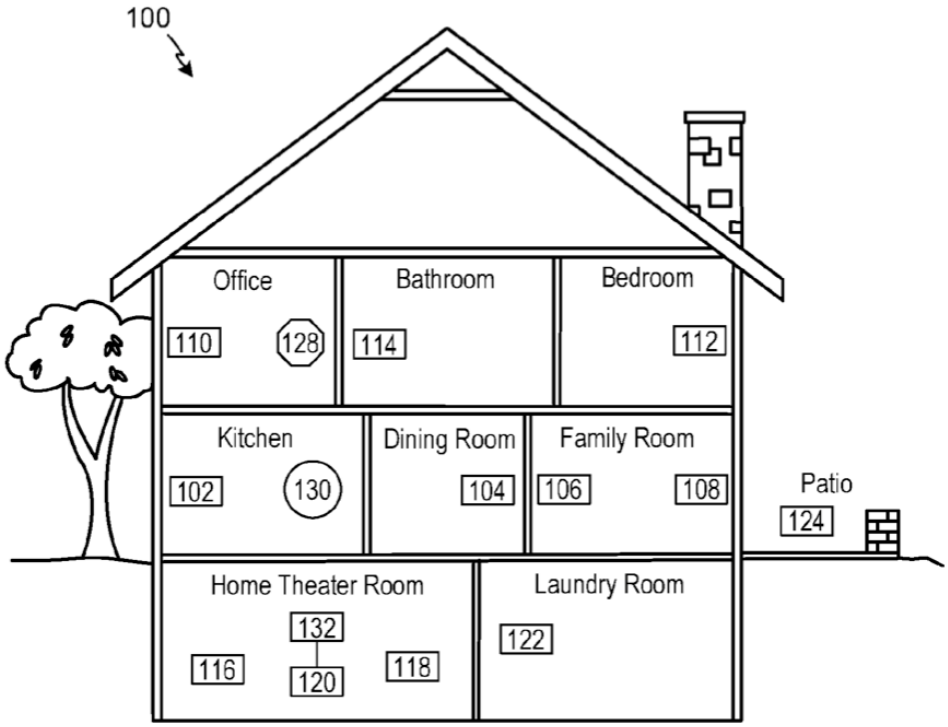
31. The '615 and '033 Patents are part of the same patent family and stem from the same original patent application, application number 13/341,237 (the "'237 Application"), filed by Sonos on December 30, 2011. In particular, the '615 Patent was filed on February 23, 2015 and is a direct continuation of the '237 Application. The '033 Patent was filed on April 19, 2019, is part of a different branch in this patent family than the '615 Patent, and ultimately claims priority back to the '237 Application through a sequence of continuations. For this Report, I have been asked to assume that the invention date for the '615 and '033 Patents is December 30, 2011.

32. The '615 and '033 Patents share a common specification. Thus, for consistency, my citations in this Report to the disclosures in this common specification are with reference to the column and line numbers of the '615 Patent's specification. That said, it should be understood that the same teachings are also found in the '033 Patent's specification.

33. The '615 Patent describes a "local playback system" (sometimes referred to as a "home music system" or "household playback system") comprising one or more "playback devices" (also referred to as "zone players") that connect to a local "data network" (also referred to as a "local area network") and are capable of playing back multimedia content, such as audio. *See, e.g.*, '615 Patent at 1:13-15, 1:66-2:9, 2:51-3:13, 3:28-31, 5:21-54, 10:64-66, 12:44-67, 16:1-8. In this respect, the '615 Patent discloses that a "playback device" has a "local playback queue" for multimedia that the "playback device" is to playback. *See, e.g.*, *id.* at 16:20-31, 16:53-57, 16:63-17:5. The '615 Patent teaches that the "playback device" contains a resource locator (e.g., a URL, an identifier, address, or other reference) corresponding to a piece of multimedia content that facilitates the "playback device" accessing that multimedia content for playback, such as from the cloud. *See, e.g.*, *id.* at 11:62-12:3, 12:53-63, 13:31-40, 15:59-67. The '615 Patent also explains that a "playback device" can queue a single piece of multimedia content or multiple pieces of multimedia content for playback, which a POSITA would understand means that the "local playback queue" could contain a single resource locator corresponding to a piece of multimedia content or multiple resource locators corresponding to respective pieces of multimedia content. *See, e.g.*, *id.* at 9:27-31, 10:42-46, 11:65-12:3, 12:49-63, 13:33-40, 15:59-62, 16:63-17:4.

34. The '615 Patent further describes control devices (e.g., "network-enabled portable devices," such as smart phones) that also connect to the local "data network" and are capable of controlling the operation of the "local playback system" (such a control device is sometimes referred to as a "controller"). *See, e.g.*, *id.* at 3:18-37, 4:52-5:11.

35. Figure 1 of the '615 Patent provides an illustrative example of a "local playback system" at a user's home comprising a variety of "playback devices" 102-124, a control device 130, and a "data network 128":



See, e.g., *id.* at 3:18-37, 5:21-28.

36. The '615 Patent also provides an illustrative example of a local "data network" that takes the form of an "Ad-Hoc network 610" and is communicatively coupled to a "cloud-based" "data network" (e.g., the Internet):

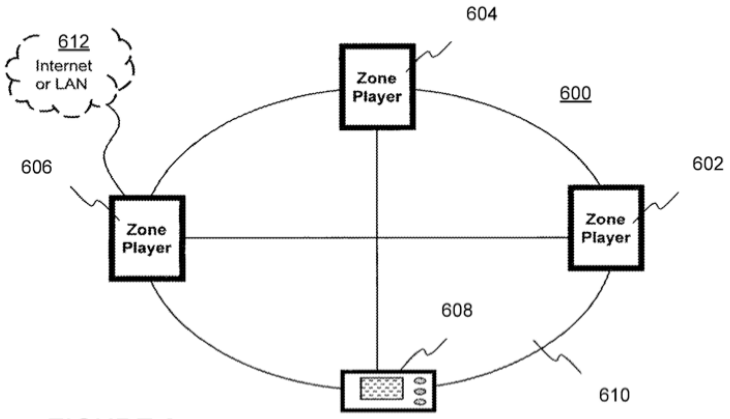


FIGURE 6

See, e.g., *id.* at 10:56-12:3.

37. In the disclosed "local playback system," each "playback device" is capable of communicating over the local "data network" with various other networked devices, including one or more other "playback devices," one or more control devices, and one or more local audio sources. *See, e.g.*, *id.* at 4:40-52, 6:61-7:12, 7:37-66, 8:12-16, 10:66-11:9, FIGS. 1, 6. Likewise, each "playback device" and control device is capable of communicating over a wide-area network (e.g., via the local "data network"), such as to retrieve audio from an Internet-based audio source. *See, e.g.*, *id.* at 5:38-41, 6:64-7:12, 12:44-67, FIG. 6.

38. The '615 Patent further provides an illustrative example of a system architecture including a cloud-based "data network" (e.g., the Internet) and multiple "local playback systems" on respective local "data networks" (760, 770):

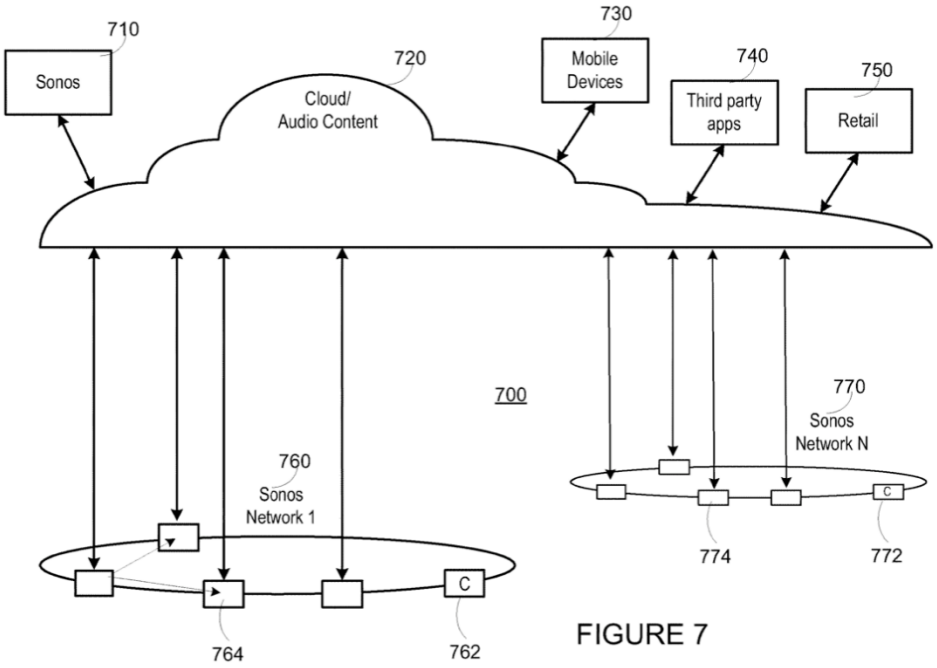


FIGURE 7

See, e.g., *id.* at 12:19-43, 16:1-8.

39. The ’615 Patent explains that the communications over the local and cloud “data networks” are in the form of digital data “packets” and are in accordance with one or more standard communication protocols, such as IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.15, or 802.3. *See, e.g.*, *id.* at 7:37-66, 11:45-51.

40. As disclosed in the ’615 Patent, control devices and “playback devices” may communicate with one another over a cloud-based “data network” to facilitate transferring playback from one device to another. For instance, the ’615 Patent discloses a variety of situations where a user is listening on his/her personal computing device to music from an Internet-based, music application (e.g., Pandora, Rhapsody, Spotify, etc.) and decides to instead have that playback be transferred to one or more “playback devices” in his/her “local playback system.” *See, e.g.*, *id.* at 12:44-13:30. The example cloud-based system architecture illustrated in Figure 7 of the ’615 Patent enables the user’s personal computing device to communicate with

one or more cloud-based servers to facilitate the transfer of playback from the personal computing device to one or more "playback devices" in a "local playback system." *See, e.g.*, *id.* at 12:19-43, 15:18-46, 16:1-8, 17:12-20. The '615 Patent further informs a POSITA that, in some embodiments, a "remote playback queue" may be involved in such a transfer of playback. *See, e.g.*, *id.* at 13:1-22, 16:63-17:4, 17:12-15, FIG. 7.

VII. "PLAYBACK QUEUE"

41. The first term that I was asked to analyze is "playback queue," which is found in the independent claims of the '615 and '033 Patents. For example, this term can be found in independent claim 13 of the '615 Patent as follows:

> after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:
>
> > (a) causing one or more first cloud servers to add multimedia content to a **local playback queue on the particular playback device**,[2] wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the **local playback queue**, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

42. As another example, this term can be found in independent claim 1 of the '033 Patent as follows:

> operating in a first mode in which the computing device is configured for playback of a **remote playback queue** provided by a cloud-based computing system associated with a cloud-based media service;
>
> while operating in the first mode, displaying a representation of one or more playback devices in a media playback system that are each i) communicatively coupled to the computing device over a data network and ii) available to accept playback responsibility for the **remote playback queue**;
>
> * * *

[2] Emphasis has been added throughout unless I noted otherwise.

based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the **remote playback queue** from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the **remote playback queue**, (ii) use the obtained data to retrieve at least one media item in the **remote playback queue** from the cloud-based media service; and (iii) play back the retrieved at least one media item;

detecting an indication that playback responsibility for the **remote playback queue** has been successfully transferred from the computing device to the at least one given playback device; and

after detecting the indication, transitioning from i) the first mode in which the computing device is configured for playback of the **remote playback queue** to ii) a second mode in which the computing device is configured to control the at least one given playback device's playback of the **remote playback queue** and the computing device is no longer configured for playback of the **remote playback queue**.

43. I understand that Sonos and Google have offered the following constructions for this term:

Sonos's Proposed Construction	Google's Proposed Construction
Plain and ordinary meaning; no construction necessary	An ordered list of multimedia items that is selected by the user for playback

44. It is my opinion that Google's proposed construction is inconsistent with how a POSITA would have interpreted the term "playback queue" in the context of the '615 and '033 Patents because (i) it does not actually define what a "playback queue" is and (ii) it adds numerous limitations into the term that a POSITA would have known were not required, which I understand to be improper when construing claim terms. In particular, as I explain in further detail below, it is my opinion that Google's proposed construction (i) provides a specific example of a type of arranged multimedia content that could be added to a "playback queue" but fails to articulate a POSITA's understanding of the term "playback queue" and (ii) improperly

adds at least three limitations that a POSITA would not understand to be required in view of the '615 and '033 Patents' intrinsic evidence:

- A requirement that a "playback queue" must have a "multimedia item" in its data form;
- A requirement that a "playback queue" must have plural "multimedia items" in an "ordered list"; and
- A requirement that a "playback queue" is limited to content "selected by the user for playback."

45. My opinions in this respect are based on my analysis of the intrinsic evidence of the '615 and '033 Patent, my own experiences, and my determination of how a POSITA would have understood the meaning of the term "playback queue" in the context of the '615 and '033 Patent at the time of the invention. Below, I set forth an explanation of the bases of my opinions with respect to this term.

A. Google's Proposed Construction Fails to Define What a "Playback Queue" Actually Is

46. As an initial matter, it is my opinion that Google's proposed construction for "playback queue" – "an ordered list of multimedia items that is selected by the user for playback" – provides a specific example of a type of arranged multimedia content that could be contained in a "playback queue" but fails to articulate a POSITA's understanding of the term "playback queue" itself.

47. In this respect, a POSITA would have understood that a "playback queue" is, in more of a colloquial sense,[3] a "container" that can hold multimedia for playback and that different types and arrangements of multimedia could be queued, such as a single song or video, a particular Internet radio station, a user-defined playlist of multiple songs/videos, a service-defined playlist of multiple songs/videos, an album of songs, etc. In this way, a POSITA would

[3] I provide more of a technical discussion of "queue" and "playback queue" in the following section.

have appreciated that Google's proposed construction appears to align more with the phrase "user-defined playlist"[4] or the like than with the phrase "playback queue."

48. In fact, the '615 Patent includes numerous disclosures demonstrating to a POSITA that "an ordered list of multimedia items that is selected by the user for playback" is merely one, specific example of an arrangement of multimedia content that a "playback queue" could contain. For example, the '615 Patent discloses queuing a single piece of multimedia for playback, such as a single audio track/song:

> [E]ach zone player 606, 604, 602 may access the Internet when retrieving media from the cloud (e.g., Internet) via the bridging device. For example, zone player 602 may ***contain a*** uniform resource locator (URL) that specifies an address to ***a particular audio track*** in the cloud. Using the URL, the zone player 602 may retrieve ***the audio track*** from the cloud, and ultimately ***play the audio*** out of one or more zone players.

'615 Patent at 11:62-12:3; *see also, e.g.*, *id.* at 10:42-46 ("[F]or example, a zone scene enables any zone(s) linked to the scene to play ***a predefined audio*** (e.g., ***a favorable song***, a predefined playlist) at a specific time and/or for a specific duration."), 13:36-40 ("[A]n application can pass ***a song identifier*** to a local playback system which looks up ***the song identifier*** and finds an available audio stream to which the user has a right to play and then plays ***that song***."), 15:59-62 ("Information passed over to the local playback device may include an identifier for ***a single track***, a playlist, a streaming radio station, a programmed radio station, and so on.").

49. As other examples, the '615 Patent discloses queuing a service-defined playlist or an Internet radio station:

> In another example of ***an application determining a playlist*** and/or other content for playback, a user enjoys listening to music on ***an online music service*** (e.g., turntable.fm or other virtual room that a user can enter to choose from ***a plurality***

[4] I discuss this in further detail below, but it is worth noting here that it is unclear to me what Google intends through its use of the language "selected by the user for playback." For example, it is not clear to me whether Google intends for its construction to only be satisfied by a user-defined playlist, which would exclude an album of songs or a service-defined playlist, for instance.

> ***of online disc jockeys (DJs) deciding what to play next***) using his Mac Book Pro™ at home. He likes the unique user experience the service offers, and he frequently hops from room to room discovering new music. To maximize sound quality, he plays the music on his household playback system (e.g., Sonos™).

'615 Patent at 13:1-10; *id.* at 15:59-62 ("Information passed over to the local playback device may include an identifier for a single track, a playlist, ***a streaming radio station***, ***a programmed radio station***, and so on.").

50. Consistent with the disclosures of the '615 Patent, publications cited on the face of the '615 and '033 Patents demonstrate that a POSITA would have understood that "an ordered list of multimedia items that is selected by the user for playback" is merely one example of an arrangement of multimedia content that a "playback queue" could contain.

51. For example, US Patent Application Publication 2011/0004330 ("Rothkopf") that was filed on July 1, 2009 and is cited on the face of each of the '615 and '033 Patents (i) describes a process for adding a single "media item" or a "playlist" of multiple "media items" to a "playback queue" (SONOS-SVG2-00042964 at ¶¶61-64, FIG. 7), (ii) illustrates an example where the "playback queue" includes a single "media item" (*id.* at ¶53, FIG. 4E), and (iii) describes an embodiment involving the system dictating what media gets queued for playback:

> The "Play Next and Others like it" option can request that the selected song be played next and then play other songs that are deemed similar to the selected song. The Genius tool used in iTunes™ can, for example, be used to determine similar songs. The "Play Artist Next" option can request that the selected song be played next and then play other songs from the same artist.

Id. at ¶54.

52. As another example, US Patent Application Publication 2012/0089910 ("Cassidy") that was filed on June 10, 2011 and is cited on the face of each of the '615 and '033 Patents (i) explains that a "playback queue" (or "play queue") can have "zero, one, or multiple media items at any given time" (SONOS-SVG2-00042982 at ¶¶45, 47-48), (ii) discloses that

"songs, albums, genres and playlists" can be added to a "play queue" (*id*. at ¶62), and (iii) describes that a "playlist" can be made by the "subscriber" or "created by the system." *Id.*

53. As yet another example, US Patent Application Publication 2014/0075308 ("Sanders") that was filed on September 10, 2012 and is cited on the face of each of the '615 and '033 Patents (i) discloses "adding an individual digital media item" or "entire playlists, albums, and other collections of music" to a "queue" (SONOS-SVG2-00043004 at ¶30), (ii) describes situations where songs are "automatically entered into the queue," such as "where the user requests the media playback application for ten songs that are similar to a selected seed song" (*id.* at ¶32), and (iii) explains that "playlists can be generated by the user or automatically generated by a third-party service, a remote server, or the media playback application." *Id.* at ¶35.

54. In summary, it is my opinion that a POSITA would have understood that "an ordered list of multimedia items that is selected by the user for playback" is merely one, specific example of an arrangement of multimedia content that could be in a "playback queue," and so, Google's proposed construction does not accurately capture a POSTA's understanding of the term "playback queue" itself in the context of the '615 and '033 Patents.

B. A "Playback Queue" Need Not Contain Any "Multimedia Item" in Its Data Form

55. Google's proposed construction for "playback queue" requires a "multimedia item":

Google's Proposed Construction
An ordered list of ***multimedia items*** that is selected by the user for playback

56. As an initial matter, Google's proposed construction for "playback queue" introduces ambiguity that would cause confusion and potential conflict with the other words of at

least the independent claims of the '615 Patent, which I understand to be improper when construing claim terms. In this respect, Google's proposed construction uses the phrase "multimedia item," which is not found in the independent claims of the '615 Patent (or of the '033 Patent). Instead, independent claim 13 of the '615 Patent recites "multimedia content" and "one or more resource locators corresponding to respective locations of the multimedia content." So, it is unclear to me whether Google's proposed phrasing of "multimedia item" refers to (i) the "multimedia content" (and in particular, the multimedia content in its data form), (ii) a "resource locator" corresponding to a location of the multimedia content, or (iii) something else.

57. Other than the above-noted ambiguity, to the extent that Google intends for its construction to ***require*** a "playback queue" to contain a given piece of multimedia content in its data form (e.g., the data representation of a song or video), as opposed to being satisfied by, e.g., a "resource locator" corresponding to the given piece of multimedia content as recited in the '615 Patent, it is my opinion that such a requirement would be contrary to a POSITA's understanding of the term "playback queue" in the context of the '615 and '033 Patents.

58. In this regard, from more of a technical standpoint, a POSITA at the time of the invention would have understood that a "queue" could be implemented in different ways and take different forms, such as a data construct (e.g., a single data variable, multiple data variables, a data array, etc.) that can contain one or more resource locators (e.g., pointers, identifiers, URLs, etc.), where each resource locator facilitates a computing device performing a task or function. To give an example, consider a computer's "print queue," which contains one or more print jobs that the computer is to complete. At the time of the invention, it was often the case that a "print queue" could contain a copy of a given document in its data form that the computer was to print or a resource locator corresponding to the given document (e.g., a pointer to a

location in the computer's memory where the file for the document is stored) that the computer was to print. In the latter case, once the current job in the "print queue" was for the computer to process the resource locator corresponding to the given document, the file containing the given document would then be accessed so the printer could carry out the actual printing.

59. For the various reasons that I explain below, in my opinion, the '615 and '033 Patents' intrinsic records would have informed a POSITA at the time of the invention to apply this general understanding to the term "playback queue" such that (i) the '615 Patent's "local playback queue on the particular playback device" may take the form of a data construct on the "playback device" that can contain one or more resource locators (e.g., identifiers, URLs, or other resource locators), where each resource locator corresponds to multimedia content (e.g., a particular song or video) that the "playback device" is to playback and (ii) the '033 Patent's "remote playback queue" may take the form of a data construct stored remote from the claimed "computing device" and "playback device" (e.g., in one or more cloud servers) that can contain data identifying one or more media items (e.g., one or more resource locators), where the identifying data corresponds to one or more media items that the "computing device" or "playback device" is to playback next.

60. **First**, a POSITA reading the entirety of the independent claims of the '615 and '033 Patents would understand that a "playback queue" is not required to contain multimedia content in its data form.

61. Starting with the '615 Patent, a POSITA that reads independent claim 13 in its entirety would readily appreciate that the "local playback queue on the particular playback device" need only contain "one or more resource locators," as opposed to multimedia content in

its data form. In fact, the full limitation where the claim term "playback queue" is found in the '615 Patent's independent claim 13 expressly states this:

> after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:
>
> > (a) causing one or more first cloud servers to add multimedia content to a **local playback queue on the particular playback device**, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the **local playback queue**, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

62. Further, following the "causing playback to be transferred from the control device to the particular playback device" limitation, the language of independent claim 13 confirms to a POSITA that the "local playback queue" need only contain "one or more resource locators," as opposed to multimedia content in its data form. In this respect, the claim further states:

> causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content.

63. A POSITA would readily appreciate that, if the term "playback queue" were interpreted (as Google appears to be proposing) to require the "local playback queue on the particular playback device" to contain a given piece of multimedia content in its data form, there would be no need for the "playback device" to "retriev[e] the multimedia content from one or more second cloud servers of a streaming content service," as set forth in the claim, because the "playback device" would already have the multimedia content in its "local playback queue." In this way, a POSITA would find Google's proposed construction to cause the claims of the '615 Patent to be inconsistent and therefore contrary to a POSITA's interpretation.

64. Relatedly, inserting Google's proposed construction into the '615 Patent's claim language (shown below) would not only result in a nonsensical read but would also require the "local playback queue" to not only contain each given piece of multimedia content in its data form but also contain a "resource locator" corresponding to the given piece of multimedia content.

> (a) causing one or more first cloud servers to add multimedia content to a **local ~~playback queue~~** [*ordered list of multimedia items that is selected by the user for playback*] on the particular playback device, wherein adding the multimedia content to the local ~~playback queue~~ [*ordered list of the multimedia items that is selected by the user for playback*] comprises the one or more first cloud servers adding, to the local ~~playback queue~~ [*ordered list of the multimedia items that is selected by the user for playback*], one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service

65. A POSITA would readily appreciate that there would be no need for the "local playback queue" to contain both a given piece of multimedia content in its data form, as well as a "resource locator" corresponding to it. This is yet another reason why a POSITA would find Google's proposed construction to cause the claims to be redundant and therefore contrary to a POSITA's interpretation.

66. Turning now to the '033 Patent, a POSITA that reads independent claim 1 in its entirety would readily appreciate that the "remote playback queue provided by a cloud-based computing system associated with a cloud-based media service" need not contain a media item in its data form. In this respect, independent claim 1 recites, in relevant part:

> operating in a first mode in which the computing device is configured for playback of a **remote <u>playback queue</u>** provided by a cloud-based computing system associated with a cloud-based media service;
>
> * * *
>
> based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the **remote <u>playback queue</u>** from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based

> computing system in order to obtain data identifying a next one or more media items that are in the **remote playback queue**, (ii) use the obtained data to retrieve at least one media item in the **remote playback queue** from the cloud-based media service ….

67. A POSITA would readily appreciate that it would make little sense for the "at least one given playback device" to (i) communicate with "the cloud-based computing system" that provides the "remote playback queue" to obtain "***data identifying*** a next one or more media items that are in the remote playback queue" and then (ii) "use the obtained data ***to retrieve*** at least one media item in the remote playback queue ***from the cloud-based media service***" if the "remote playback queue" (provided by "the cloud-based computing system") already contained the at least one media item in its data form (as Google appears to be proposing). This is an additional reason why a POSITA would find Google's proposed construction to cause the claims to be redundant and therefore contrary to a POSITA's interpretation.

68. **Second**, a POSITA that reads the '615 Patent in its entirety would readily appreciate that a "playback queue" need not contain multimedia content in its data form and instead may only include one or more resource locators (or other identifying data) of multimedia content.

69. In this regard, as I explained before, the '615 Patent teaches that a "playback device" can queue a single piece of multimedia content or multiple pieces of multimedia content for playback, which a POSITA would understand means that the "local playback queue" of the "playback device" could contain a single resource locator (e.g., a URL, identifier, or some other resource locator) corresponding to a piece of multimedia content or multiple resource locators corresponding to respective pieces of multimedia content. For example, the '615 Patent states:

> [E]ach zone player 606, 604, 602 may access the Internet when retrieving media from the cloud (e.g., Internet) via the bridging device. For example, ***zone player 602 may contain a uniform resource locator (URL)*** that specifies an address to a

> particular audio track in the cloud. ***Using the URL, the zone player 602 may retrieve the audio track from the cloud***, and ultimately play the audio out of one or more zone players.

'615 Patent at 11:62-12:3. As another example, the '615 Patent states:

> A uniform resource indicator (URI) (e.g., a uniform resource locator (URL)) can be passed to a playback device to fetch content from a cloud and/or other networked source, for example. A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has ***a URL (or some other identification or address) for a song*** and/or playlist, the zone player can run on its own to ***fetch the content***. Songs and/or other multimedia content can be retrieved from the Internet rather than a local device ….

Id. at 12:53-63; *see also id.* at 13:36-40 ("[A]n application can pass ***a song identifier*** to a local playback system which looks up the song identifier and finds an available audio stream to which the user has a right to play and then plays that song."), 15:59-62 ("Information passed over to the local playback device may include ***an identifier for*** a single track, a playlist, a streaming radio station, a programmed radio station, and so on.").

70. **Third**, a POSITA having read the '615 Patent's file history would understand that the "local playback queue on the particular playback device" need only contain "one or more resource locators," as opposed to multimedia content in its data form, which undercuts Google's proposed construction for "playback queue."

71. In this regard, in its August 28, 2017 Office Action Response, Sonos distinguished the Togashi reference's disclosures by arguing that the "wherein" clause modifying the limitation "causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device" found in the independent claims specifies ***how*** the "one or more first cloud servers" "add multimedia content to a local playback queue on the particular playback device":

> Instead of requesting a content server to change the destination of the audio content [as in Togashi], Applicant's claims recite a different technique for transferring

> playback of multimedia content between devices. In particular, Applicant's claims recite "causing ***one or more first cloud servers*** to **add the multimedia content** to a local playback queue on the particular playback device" **by "adding,** to the local playback queue, **one or more resource locators** corresponding to respective locations of the multimedia content at the ***one or more second cloud servers*** of a streaming content service."

Office Action Response Dated August 28, 2017 at 4 (bold and italics original; bold and underlined added) (attached as Appendix B). The claims were allowed after Sonos's August 28, 2017 response.

72. **Fourth**, at least one publication cited on the face of the '615 and '033 Patents demonstrates that a POSITA would understand, contrary to Google's proposed construction, that a "playback queue" need not contain multimedia content in its data form. In this respect, Rothkopf explains:

> It should be noted that the playback queue ***can but need not*** contain digital content for any of the media items in the playback queue. Instead, the playback queue ***need only include a reference or pointer*** to the digital content for the particular media item.

SONOS-SVG2-00042964 at ¶67.

73. In sum, to the extent that Google intends for its construction to ***require*** a "playback queue" to contain multimedia content in its data form, as opposed to being satisfied by, e.g., a "resource locator" corresponding to the multimedia content, it is my opinion that such a requirement would be contrary to a POSITA's understanding of the term "playback queue" in the context of the '615 and '033 Patents.

C. A "Playback Queue" Need Not Include Plural "Multimedia Items,"[5] Much Less an "Ordered List" of Plural "Multimedia Items"

74. Google's proposed construction for "playback queue" further requires plural "multimedia items" and those plural "multimedia items" to be in an "ordered list":

Google's Proposed Construction
An ***ordered list*** of multimedia ***items*** that is selected by the user for playback

75. I disagree that a POSITA would have interpreted the term "playback queue" in the context of the '615 and '033 Patents as requiring plural "multimedia items," much less an "ordered list" of plural "multimedia items."

76. **First**, Google's construction requiring a "playback queue" to have plural "multimedia items" is contrary to how POSITAs generally used the term "queue" at the time of the invention. For instance, it was common knowledge of a POSITA at the time of the invention that a computing device's "queue" could have multiple resource locators that facilitate tasks/functions that the computing device was to perform and that "queue" would remain a "queue" (i) even as the computing device performed the tasks/functions such that only a single resource locator for a single task/function remained in the "queue" and (ii) even after the computing device performed the final task/function in the "queue" such that the "queue" became empty.

77. Despite this common knowledge of a POSITA, Google's proposed construction would result in something being a "playback queue" at one moment in time depending on its contents but not being a "playback queue" at another moment in time when its contents change

[5] I already addressed my objection to Google's use of "multimedia item" in its proposed construction. This and the following section assume for sake of argument that Google's use of "multimedia item" does not refer to a given item of multimedia in its data form.

to be less than two. In my opinion, such a result is contrary to how a POSITA would have understood the term "playback queue" in the context of the '615 and '033 Patents.

78. In fact, I see nothing in the intrinsic record of either the '615 or '033 Patent limiting "playback queue" to something that has plural "multimedia items." To the contrary, the intrinsic record confirms that a "playback queue" is not required to have plural "multimedia items."

79. For starters, the plain language of the '615 Patent's independent claims merely requires the "local playback queue" to contain "***one*** or more resource locators":

> (a) causing one or more first cloud servers to add multimedia content to a **local playback queue on the particular playback device**, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service

80. Similarly, the plain language of the '033 Patent's independent claims merely requires the "remote playback queue" to contain "a next ***one*** or more media items":

> based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the **remote playback queue** from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the **remote playback queue**, (ii) use the obtained data to retrieve at least one media item in the **remote playback queue** from the cloud-based media service; and (iii) play back the retrieved at least one media item;

81. Relatedly, as I explained before, the '615 Patent repeatedly describes queuing only a single piece of multimedia content for playback, which a POSITA would understand means that the "playback queue" would contain a single resource locator corresponding to (or data identifying) a single piece of multimedia content, as opposed to plural "multimedia items." *Supra* ¶48; *see also, e.g.*, '615 Patent at 12:49-63:

> The ***playback system*** picks up from the same spot on the selected channel that was on her phone and outputs that content (e.g., ***that song***) on speakers and/or other playback devices connected to the household playback system. A uniform resource indicator (URI) (e.g., a uniform resource locator (URL)) can be passed to a playback device to fetch content from a cloud and/or other networked source, for example. A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has ***a*** URL (or some other identification or address) for ***a song*** and/or playlist, the zone player can run on its own to fetch the content.

Id. at 12:49-63.

82. Thus, I see nothing in the claims of the '615 or '033 Patents or the specification limiting the "playback queue" to something that has plural "multimedia items."

83. Moreover, publications cited on the face of the '615 and/or '033 Patents demonstrate that a POSITA would not have interpreted the term "playback queue" in the context of the '615 and '033 Patent to require plural "multimedia items."

84. For example, Cassidy (cited on the face of the '615 and '033 Patents) explains that a "playback queue" (or "play queue") can have "***zero***, ***one***, or multiple media items at any given time." *See, e.g.*, SONOS-SVG2-00042982 at ¶45 ("The media application can maintain a ***playback queue for media playback*** by the mobile communications device. At any time, the ***playback queue*** can include ***zero*** or more ***items of media***, e.g. songs."), ¶47 ("[T]he media items are selectable for use in management of the ***play queue***, which can include ***zero, one***, or multiple ***media items at any given time***."), ¶48 ("The SuperPlay button 506 can be selected to manage the ***playback queue*** of the media application. If no songs are playing and no songs have been selected for playback, the ***playback queue is empty***.").

85. As another example, Rothkopf (cited on the face of the '615 and '033 Patents) similarly explains that a "playback queue" could be empty or only contain one "digital media asset." *See, e.g.*, SONOS-SVG2-00042964 at ¶14 ("[P]roviding a ***queue*** for identifying ***one*** or

more digital media assets that are to be played back at the client computing device"), ¶37 ("As one digital media asset completes its playback, another digital media asset to be then played back can be obtained from the ***playback queue*** 110, ***unless*** such is ***empty***."), FIG. 4E.

86. In sum, there is nothing in the intrinsic evidence indicating that a POSITA would have interpreted the term "playback queue" in the context of the '615 and '033 Patents to ***require*** having plural "multimedia items." This is another reason why I disagree with Google's proposed construction.

87. **Second**, even assuming a "playback queue" must contain plural "multimedia items," as Google proposes, a POSITA at the time of the invention would have known that an "ordered list" was not necessary. For instance, a POSITA would have appreciated that a "playback queue" is more about the general concept of defining what is to played back than a singularly defined type of data structure, and thus, a POSITA would have understood that a "playback queue" could be implemented in different ways and take different forms.

88. In this regard, a POSITA would have known that a "playback device" could store in its memory plural "multimedia items" across multiple data variables (in other words, not stored as an "ordered list") and still playback the media in a specified order. For instance, the "playback device" could have a data variable called "play_now" that gets populated by a first "multimedia item" and another data variable called "play_next" that gets populated by a second "multimedia item" and have logic to play the media corresponding to the "play_now" data variable before the media corresponding to the "play_next" data variable. In my opinion, a POSITA would have considered at least the collection of the "play_now" and "play_next" data variables in this example as a "local playback queue on the particular playback device." However, Google's proposed construction for "playback queue" precludes examples such as this.

89. Moreover, the '615 Patent discloses queuing plural media items for playback without requiring the "playback queue" to contain an "ordered list." In this regard, the '615 Patent teaches embodiments where a "playback device" queues a single resource locator, such as a URL or some other identification, that corresponds to a playlist of multiple media items. *See, e.g.*, '615 Patent at 12:56-61:

> A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has ***a*** URL (or some other identification or address) for ***a*** song and/or ***playlist***, the zone player can run on its own to fetch the content.

Id. at 15:59-62 ("Information passed over to the local playback device may include ***an identifier for*** a single track, ***a playlist***, a streaming radio station, a programmed radio station, and so on.").

90. Because Google's proposed construction precludes example embodiments from the specification and examples that a POSITA would have understood fall under the plain and ordinary meaning of a "playback queue," it is my opinion that Google's proposed construction is inconsistent with how a POSITA would have interpreted the term "playback queue" in the context of the '615 and '033 Patents.

D. A "Playback Queue" Is Not Limited to User-Selected Content

91. Google's proposed construction for "playback queue" further requires that the "ordered list of multimedia items" be "selected by the user for playback":

Google's Proposed Construction
An ordered list of multimedia items that is ***selected by the user for playback***

92. As I noted before, it is unclear to me what Google intends by the usage of "selected by the user for playback." For instance, it is unclear to me whether this language means (i) that the user must select each of the multimedia items that constitute the ordered list, (ii) that the user must make a list-level selection (as opposed to a multimedia-item selection),

such as by selecting the name of a predefined playlist or album for playback, or (iii) something else

93. Relatedly, it is unclear to me whether Google intends this language to exclude, for example, (i) queuing a playlist of media items that is curated by a third-party media service, (ii) automatically queuing an album of songs by virtue of the user selecting the first song of the album and a system, service, or application automatically queueing the other songs in the album, or (iii) automatically queuing one or more media items that are similar to, or otherwise seeded by, a user-selected media item. To the extent that Google intends for its proposed construction to exclude any of these scenarios, that would be inconsistent with a POSITA's understanding of the term "playback queue" in the context of the '615 and '033 Patents.

94. In this regard, as I explained before, the specification of the '615 and '033 Patents and various publications cited on their face demonstrate that a "playback queue" could contain a ***service***-defined playlist and that a "playback queue" could be automatically populated with one or more pieces of multimedia content by a system, service, or application, as opposed to manually by a user. *Supra* ¶¶49-53.

95. To recap, I have seen nothing in the intrinsic evidence indicating that a POSITA would have interpreted the term "playback queue" in the context of the '615 and '033 Patents to be limited to an "ordered list of multimedia items … selected by the user for playback." This is yet another reason why I disagree with Google's proposed construction.

VIII. "RESOURCE LOCATOR"

96. The next term that I was asked to analyze is "resource locator," which is found in the independent claims of the '615 Patent. For example, this term can be found in independent claim 13 as follows:

after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:

(a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, **one or more resource locators** corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

97. I understand that Sonos and Google have offered the following constructions for this term:

Sonos's Proposed Construction	Google's Proposed Construction
Plain and ordinary meaning; no construction necessary	Address of a resource on the Internet

98. It is my opinion that Google's proposed construction is inconsistent with how a POSITA would have interpreted the term "resource locator" in the context of the '615 Patent because it adds limitations into the claims that a POSITA would have known were not required, which I understand to be improper when construing claim terms.

99. My opinions in this respect are based on my analysis of the intrinsic and extrinsic evidence of the '615 Patent, my own experiences, and my determination of how a POSITA would have understood the meaning of the term "resource locator" in the context of the '615 Patent at the time of the invention. Below, I set forth an explanation of the bases of my opinions with respect to this term.

A. "Resource Locator" Is Broader Than "Uniform Resource Locator"

100. For starters, I reviewed Google's Preliminary Claim Constructions and Evidence Pursuant to Patent Local Rule 4-2 and all of the dictionary definitions identified by Google in support of its proposed construction for "resource locator" are for "uniform (or universal) resource locator" (or "URL"), as opposed to "resource locator." Appendix C at 13-14. Notably,

I find Google's proposed construction to be too narrow (in a general context) even for the phrase "uniform resource locator" because it requires an "address," whereas a POSITA would understand a "URL" is not so limited. In this respect, a POSITA would have known that a "URL" is more broadly an identifier or pointer to a resource accessible on the Internet.

101. Turning back to the actual claim language "resource locator," it is my opinion that a POSITA would have understood that, at the time of the invention, the term "resource locator" had a broader meaning than that proposed by Google. In this regard, a POSITA would have known that "resource locator" more generally refers to information that enables a device to access a resource and that information could take various forms, such as an identifier, address, uniform resource indicator (URI), URL, or some other reference that facilitates a device accessing a resource. In other words, a POSITA would have known that a URL is merely one specific type of a "resource locator."

102. Relatedly, it is my opinion that a POSITA would have known at the time of the invention that, when the phrase "resource locator" was used divorced from the fuller phrase "uniform (or universal) resource locator," the lack of "uniform" (or "universal") was meaningful and meant that something broader than a URL was intended.

103. Further, it is my opinion that a POSITA at the time of the invention would have known that, in the context of the '615 Patent (as in the general context), a "resource locator" and a "URL" are not one and the same. For instance, the '615 Patent's specification makes clear to a POSITA that a "URL" is just one type of a "resource locator" and that "resource locator" has a broader meaning than an "address of a resource on the Internet," as Google proposes. For example, the '615 Patent describes use of a URL or "some other identification" that enables a "playback device" to fetch a song or playlist:

> A uniform resource indicator (URI) (e.g., a uniform resource locator (URL)) can be passed to a playback device to fetch content from a cloud and/or other networked source, for example. . . . A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has a URL (***or some other identification*** or address) for a song and/or playlist, the zone player can run on its own to fetch the content.

'615 Patent at 12:53-61. As another example, the '615 Patent describes use of "a song identifier" that enables a "playback device" to access a stream for that song:

> [A]n application can pass ***a song identifier*** to a local playback system which looks up the song identifier and finds an available audio stream to which the user has a right to play and then plays that song.

Id. at 13:36-40. As yet another example, the '615 Patent describes "information," such as "an identifier," that enables a "playback device" to access and retrieve music on the Internet:

> Information passed over to the local playback device may include ***an identifier*** for a single track, a playlist, a streaming radio station, a programmed radio station, and so on. . . . Once the music information is handed from the third-party application to the local playback system, there is no further synchronization between the two systems.

Id. at 15:59-67; *see also, e.g.*, *id.* at 16:6-19 ("***Information*** can be passed locally, rather than through the Internet, for example. The local playback device accesses the Internet to find content to stream, and the third party application takes the place of the controller application.").

104. Thus, it is my opinion that a POSITA would understand from reading the '615 Patent that the claimed "resource locator" is meant to encompass more than just a "URL," as evidenced by at least the '615 Patent's references to "some other identification," "identifier," and "information" that facilitates the "playback device" accessing and retrieving a resource (e.g., a track of music).

105. Moreover, I have also seen extrinsic evidence that is consistent with the '615 Patent using the term "resource locator" with a broader meaning than Google's proposed construction of an "address of a resource on the Internet."

106. For example, US Patent 8,533,469 that was filed on November 23, 2009 explains that a "resource locator may be a reference associated with [an] electronic document that would allow user 106 to locate or request access to the electronic document," where the "electronic document" is the "resource." SONOS-SVG2-00043153 at 3:32-34; *see also, id.* at 3:65-67 ("'doc_id' may be the resource locator unique to the desired electronic document, '1234' may be the value of the resource locator ….").

107. As another example, US Patent 8,386,495 – one of Google's own patents – that was filed on April 23, 2010 (i) explains that a "resource locator is a string of characters that identifies a resource and provides a means for locating the resource," (ii) refers to a URL as one kind of "resource locator," and (iii) explains that a "resource is any data that can be provided by a website or other source, e.g., over a network, and that is associated with a resource address," such as "images, video, and feed sources, to name just a few." SONOS-SVG2-00043078 at 3:14-27. Similarly, US Patent Application Publication 2010/0235469 from March 11, 2009 states a "resource locator is an identifier for locating a resource." SONOS-SVG2-00043131 at ¶27.

108. As yet another example, US Patent 8,032,612 with priority date of January 31, 2003 states, "[i]n the context of the present invention, the term 'resource locator' … is defined as an identifier used for accessing a resource" and provides examples of a "resource locator" being "the name of the resource," a "Uniform Resource Identifier (URI)" and a "uniform resource locator (URL)." SONOS-SVG2-00043035 at 5:16-21.

109. Thus, it is my opinion that Google's proposed construction is incorrect because a POSITA would have interpreted the term "resource locator" in the context of the '615 Patent in a broader manner than an "address of a resource on the Internet."

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: February 11, 2022

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Appendix A

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Educational Background

- **Ph.D. Computer Science**, summer 1994, University of California, Irvine
  Dissertation: "An Object-Oriented Framework for Experimenting with Alternative Process Architectures for Parallelizing Communication Subsystems."
  Co-advisors: Dr. Tatsuya Suda and Dr. Richard W. Selby.
- **M.S. Computer Science**, summer 1990, University of California, Irvine, specializing in software engineering.
- **M.A. Sociology**, summer 1986, College of William and Mary, Williamsburg, Virginia
  Thesis: "A Statistical Analysis of University Resource Allocation Policies."
  Advisor: Dr. Michael A. Faia.
- **B.A. Sociology**, summer 1984, College of William and Mary, Williamsburg, Virginia.

Professional Experience

1. **7/1/18 – present: Associate Provost of Research Development and Technologies**
   Develop cohesive and sustainable information technology (IT) services to advance research and scholarship across Vanderbilt's ten schools and colleges; develop scalable storage and processing solutions by leveraging on-campus and cloud data storage services, as well as creating big data research cores and core-related services; and implement NIST 800-171 compliant IT services.
2. **8/1/18 – present: Co-Director of the Vanderbilt Data Science Institute**
   Facilitate highly innovative research and education initiatives that build on Vanderbilt University's current strengths, promote new collaborations, and establish a cohesive institutional framework that embraces Vanderbilt's diverse campus, while establishing the university as a leader in data science research and education.
3. **2/17 – present: Cornelius Vanderbilt Professor of Engineering**
   Received an endowed chair in recognition of my scholarship, intellect, and leadership in the field of computer science and computer engineering.
4. **1/03 – present: Full Professor with tenure**
   Conducting research on patterns, optimizations, and experimental analysis of advanced generative software techniques that facilitate the development of distributed real-time and embedded middleware and model driven architectures running over high-speed networks and interconnects in the Department of Electrical Engineering and Computer Science at Vanderbilt University.
5. **02/16 – 7/31/18: Associate Chair of Electrical Engineering and Computer Science**
   Provide intellectual leadership within the EECS department. Coordinate with EECS Chair to assist in EE, CS, and CompE curriculum development and course staffing. Assist the faculty in building industry and federal programs for EECS. Assist the Chair in mentoring junior EECS faculty. Assist the EECS Chair in improving the ranking of the EECS programs. Assist the Chair in increasing the quality and number of undergraduate and graduate student applications to the EECS programs.
6. **12/04 – 1/16: Associate Chair of Computer Science and Engineering**
   Provide intellectual leadership within the CS program. Coordinate with EECS Chair to assist in CS and CompE (CS&E) curriculum development and course staffing. Assist the faculty in building industry and federal programs centered in CS&E and IT for EECS. Assist the Chair in mentoring

junior CS&E faculty. Assist the EECS Chair in improving the ranking of the CS&E programs. Assist the Chair in increasing the quality and number of undergraduate and graduate student applications to the CS&E programs.

7. **4/13 – 2/18: Member of the Board of Directors at Real-Time Innovations (RTI)**.
   Work with the CEO and other members of the Board of Directors of RTI to help assess company technical and business strategy.
8. **1/12 – present: Visiting Scientist at the Software Engineering Institute**
   Assist the SEI Director's Office in formulating the SEI's technology strategy for R&D projects and external relationships by aligning the expertise of the SEI technical staff to identify and respond to the needs of sponsors, customers, and partners and help the SEI shape future innovations in complex software-reliant systems.
9. **7/11 – 7/13: Adjunct Professor of Software Engineering** in the Institute for Software Research in the School of Computer Science at Carnegie Mellon University.
10. **9/10 – 12/11: Deputy Director and Chief Technology Officer at the Software Engineering Institute (SEI)**
    Lead the formulation of the SEI's technology strategy for R&D projects and external relationships by aligning the expertise of the SEI technical staff to identify and respond to the needs of sponsors, customers, and partners and help the SEI shape future innovations in complex software-reliant systems.
11. **07/05 – 8/10: Visiting Scientist at the Software Engineering Institute**
    Assisted Linda Northrop and the Ultra-Large-Scale (ULS) Systems team to define the challenge problems, promising technology areas, and research roadmaps for the national R&D effort on building the software-reliant systems of the future that are likely to have billions of lines of code. This activity is defining a broad, multi-disciplinary research agenda for developing ULS systems of the future.
12. **06/09 – 8/10: Chief Technology Officer for Zircon Computing**
    Assisted in the strategic direction of Zircon Computing technology development in the areas of adaptive distributed computing middleware for high-performance and real-time applications. Help to formulate the technology strategy for open-source middleware platforms, R&D partnerships, and external relationships.
13. **6/07 – 8/07: Visiting Professor at Trinity College Dublin**
    Worked with Professor Vinny Cahill and the Distributed Systems Group at Trinity College on topics pertaining to service-oriented architectures and autonomic computing.
14. **10/06 – 5/09: Chief Technology Officer for PrismTechnologies**
    Assisted in the strategic direction of PrismTechnologies technology development in the areas of open-source middleware platforms and model-driven tools. Help to formulate the technology strategy for open-source middleware platforms and model-driven tools, R&D partnerships, and external relationships.
15. **3/02 – 12/02: Program Manager**
    Led the National effort on middleware as a Program Manager for over $60 million dollars of funding at the DARPA Information Exploitation Office (IXO). Programs include Program Composition for Embedded Systems (PCES) and National Experimentation Platform for Hybrid and Embedded Systems (NEPHEST).
16. **9/01 – 3/02: Deputy Director**
    Served as the Deputy Director for the DARPA Information Technology Office (ITO), helping set and guide the National IT research and development agenda and manage programs on autonomous systems, network-centric command and control systems, combat systems, real-time avionics systems, distributed real-time and embedded systems, and augmented cognition for the U.S. Department of Defense.
17. **6/00 – 3/02: Program Manager**
    Led the National effort on middleware as a Program Manager for over $60 million dollars of funding at the DARPA Information Technology Office (ITO). Programs included the Program Composition for Embedded Systems (PCES).

18. **6/01 – 6/02: Co-chair for the Software Design and Productivity (SDP) Coordinating Group**
    The SDP Coordinating Group formulates the multi-agency research agenda in fundamental software design for the Federal government's Networking and Information Technology Research and Development (NITR&D) Program, which is the collaborative IT research effort of the major Federal science and technology agencies.
19. **8/99 – 2002: Associate Professor with tenure**
    Conducted research on patterns, implementation, and experimental analysis of object-oriented techniques that facilitate the development of high-performance, distributed real-time and embedded computing systems on parallel processing platforms running over high-speed networks and embedded system interconnects in the Department of Computer Engineering at the University of California, Irvine.
20. **6/99 – 8/99: Associate Professor with tenure**
    Conducted research on patterns, implementation, and experimental analysis of object-oriented techniques that facilitate the development of high-performance, distributed real-time and embedded computing systems on parallel processing platforms running over high-speed networks and embedded system interconnects in the Department of Computer Science and the Department of Radiology at Washington University in St. Louis.
21. **6/98 – 6/99: Associate Professor without tenure (early promotion)**
    Conducted research on patterns, implementation, and experimental analysis of object-oriented techniques that facilitate the development of high-performance, distributed real-time and embedded computing systems on parallel processing platforms running over high-speed networks and embedded system interconnects in the Department of Computer Science and the Department of Radiology at Washington University in St. Louis.
22. **8/94 – 6/98: Assistant Professor**
    Conducted research on object-oriented patterns and techniques for developing highly extensible, high-performance communication frameworks in the Department of Computer Science and the Department of Radiology at Washington University in St. Louis.
23. **3/91 – 8/94: Research Assistant**
    Developed object-oriented frameworks for multi-processor-based communication subsystems with Professor Tatsuya Suda at the University of California, Irvine.
24. **6/90 – 11/90: Member of the Technical Staff**
    Worked as a software engineer for Independence Technologies, which was one of the largest suppliers of enterprise-level TUXEDO systems, providers of professional services, and developers of management and connectivity software to support OLTP environments.
25. **8/88 – 3/91: Research Assistant**
    Devised measurement-guided software development techniques for large-scale software systems with Professor Richard Selby at the University of California, Irvine.
26. **6/88 – 8/88: Research Assistant**
    Studied the impact of computing on end-users in forty U.S. city governments with Dr. John King and the URBIS project at the Public Policy Research Organization, University of California, Irvine.
27. **Summer of 87: Technical Intern**
    Worked with Dr. Peter G. W. Keen at the International Center for Information Technology, Washington D.C. on various projects, including software productivity, videotex, and smartcards.
28. **9/86 – 5/88: Teaching Assistant**
    Developed programming assignments, grading tools, and led recitation sessions for a number of undergraduate Computer Science courses at the University of California, Irvine.
29. **Summer of 86: Statistical Programmer**
    Programmed SPSS and SAS applications for the "Justice Delayed" project under the direction of Dr. Gene Flango at the National Center for State Courts, Williamsburg, Virginia.
30. **1/85 – 8/86: Research Assistant**
    Examined university resource allocation policies via statistical analysis under the direction of Dr. Michael Faia at the College of William and Mary, Williamsburg, Virginia.

Publications

In Print

- **Refereed Journal Publications**

J129 Peng Zhang, Christopher Fonnesbeck, Douglas C. Schmidt, Jules White, Samantha Kleinberg, Shelagh A. Mulvaney, "Understanding Barriers to Self-Management in Type 1 Diabetes Using Machine Learning and Momentary Assessment," the JMIR *Journal of mHealth and uHealth*, 2022 (to appear).

J128 Summer Weber, Elyse Shearer, Shelagh Mulvaney, Douglas C. Schmidt, Chris Thompson, Jessica Jones, Haseeb Ahmad, Martina Coe, and Pam Hull, "Prioritization of Features for Mobile Phone Applications for Families in a Federal Nutrition Program for Low-income Women, Infants, and Children: User-Centered Design Approach," *JMIR Formative Research*, Vol 5., No 7., July 2021.

J127 Alex Roehrs, Cristiano A. da Costa, Rodrigo R. Righi, Andre H. Mayer, Valter F. da Silva, Jose R. Goldim, and Douglas C. Schmidt, "Integrating Multiple Blockchains to Support Distributed Personal Health Records," the SAGE *Health Informatics Journal*, April, 2021.

J126 Zhongwei Teng, Peng Zhang, Xiao Li, William Nock, Denis Gilmore, Marcelino Rodriguez-Cancio, Jules White, Jonathan C. Nesbitt, Douglas C. Schmidt, "Authentication and Integration Approaches for mHealth Apps from a Usability View," the journal *Advances in Electrical and Electronic Engineering*, North America, 19, March, 2021.

J125 Scott Eisele, Aron Laszka, Douglas C. Schmidt, and Abhishek Dubey, "The Role of Blockchains in Multi-Stakeholder Transactive Energy Systems," the journal *Frontiers in Blockchain: Emerging Technologies and Blockchain in Action: Applications in Supply Chain Management and Energy*, to appear 2021.

J124 Peng Zhang, Chris Downs, Nguyen Thanh Uyen Le, Cory Martin, Paul Shoemaker, Clay Wittwer, Luke Mills, Liam Kelly, Stuart Lackey, Douglas C. Schmidt, Jules White, "Towards Patient-centered Stewardship of Research Data and Research Participant Recruitment with Blockchain Technology," the *Frontiers in Blockchain special selection on Non-Financial Blockchain*, 2020, volume 3, pps. 1-32.

J123 Yao Pan, Fangzhou Sun, Jules White, Douglas C. Schmidt, Jacob Staples, Lee Krause, and Zhongwei Teng, "Detecting Web Attacks with End-to-End Deep Learning," the Springer *Journal of Internet Services and Applications*, 2019, volume 10, number 16, pps. 1-22.

J122 Shelagh Mulvaney, Lori Laffel, Korey Hood, Cindy Lybarger, Sarah Vaala, and Douglas C. Schmidt, "A Mobile App Identifies Momentary Psychosocial and Contextual Factors Related to Mealtime Self-Management in Adolescents with Type 1 Diabetes," Journal of the American Medical Informatics Association, Oxford University Press, 2019, Volume 26, Number 12, pps. 1627-1631.

J121 Maria E. Powell, Marcelino Rodriguez Cancio, David Young, William Nock, Beshoy Abdelmessih, Amy Zeller, Irvin Perez Morales, Peng Zhang, C Gaelyn Garrett, Douglas Schmidt, Jules White, and Alexander Gelbard, "Decoding Phonation with Artificial Intelligence (DEP AI): Proof of Concept," the *Laryngoscope Investigative Otolaryngology* journal, Wiley-Blackwell, Volume 4, Issue 3, 2019, pps. 328-334.

J120 Alex Roehrs, Cristiano Andre da Costa, Rodrigo da Rosa Righi, Valter Ferreira da Silva, Jose Roberto Goldim, and Douglas C. Schmidt, "Analyzing the Performance of a Blockchain-based Personal Health Record Implementation," the *Journal of Biomedical Informatics*, Elsevier, volume 92, 2019.

J119 Peng Zhang, Breck Stodghill, Cory Pitt, Cavan Briody, Douglas C. Schmidt, Jules White, Alan Pitt, and Kelly Aldrich, "OpTrak: Tracking Opioid Prescriptions via Distributed Ledger Technology," the *International Journal of Information Systems and Social Change (IJISSC)*, Special Issue On: Blockchain Technology: Platforms, Tools, and Use Cases, IGI Global, Volume 10, Number 2, 2019.

J118 Peng Zhang, Jules White, Douglas C. Schmidt, Gunther Lenz, S. Trent Rosenbloom, "FHIRChain: Applying Blockchain to Securely and Scalably Share Clinical Data," the Elsevier *Computational and Structural Biotechnology Journal* – Blockchain and Distributed Ledger Technologies in Biology, Medicine, and eHealth Special Issue, Volume 16, July 2018, pp 267–278.

J117 Shelagh A Mulvaney, Sarah Vaala, Korey K Hood, Cindy Lybarger, Rachel Carroll, Laura Williams, Douglas C Schmidt, Kevin Johnson, Mary S Dietrich, and Lori Laffel, "Mobile Momentary Assessment and Bio-Behavioral Feedback for Adolescents with Type 1 Diabetes: Feasibility, Engagement Patterns, and Relation with Blood Glucose Monitoring," ¡EM¿Journal of Diabetes Technology and Therapeutics¡/EM¿, Vol 20, No. 7, July 2018, pp 465–474.

J116 Subhav Pradhan, Abhishek Dubey, Shweta Khare, Saideep Nannapaneni, Aniruddha Gokhale, Sankaran Mahadevan, Douglas C Schmidt, Martin Lehofer, "CHARIOT: A Holistic, Goal Driven Orchestration Solution for Resilient IoT Applications," the ACM Transactions on Cyber-Physical Systems, Vol 2, No. 3, July 2018, pp 1-37.

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J114 Yao Pan, Jules White, Douglas C. Schmidt, Ahmed Elhabashy, Logan Sturm, Jaime Camelio, and Christopher Williams, "Taxonomies for Reasoning About Cyber-physical Attacks in IoT-based Manufacturing Systems," Special Issue on Advances and Applications in the Internet of Things, edited by Vicente Garcia Diaz, International Journal of Interactive Multimedia and Artificial Intelligence, volume 4, number 3, 2017, pp. 45-54.

J113 Gordon Blair, Douglas C. Schmidt, and Chantal Taconet, "Middleware for Internet Distribution in the Context of Cloud Computing and the Internet of Things," Springer Journal Annals of Telecommunications, April 2016, Volume 71, Issue 3, pp. 87-92.

J112 Yu Sun, Jules White, Sean Eade, and Douglas C. Schmidt, "ROAR: A QoS-Oriented Modeling Framework for Automated Cloud Resource Allocation and Optimization", the Journal of Systems and Software, Elsevier, volume 116, issue C, June 2016 pp. 146.161.

J111 Nick Guertin, Brian Womble, Paul Bruhns, Douglas C. Schmidt, Adam Porter, and Bill Antypas, "Management Strategies for Software Infrastructure in Large-Scale Cyber-Physical Systems for the US Navy," Cutter IT Journal, Vol. 28, No. 5, May 2015, pp. 14-18.

J110 Jules White, Josi A. Galindo, Tripti Saxena, Brian Dougherty, David Benavides, Douglas C. Schmidt, "Evolving Feature Model Configurations in Software Product Lines," Journal of Systems and Software, Volume 87, 2014, pp. 119-136.

J109 Akram Hakiri, Aniruddha S. Gokhale, Pascal Berthou, Douglas C. Schmidt, Thierry Gayraud, Software-Defined Networking: Challenges and Research Opportunities for the Future Internet," Journal of Computer Networks, Volume 75, 2014, pp. 453-471.

J108 Hamilton Turner, Brian Dougherty, Jules White, Jonathan Preston, Russell Kegley, Douglas C. Schmidt, and Aniruddha Gokhale, "DRE System Performance Optimization with the SMACK Cache Efficiency Metric," Elsevier Journal of Systems and Software, Volume 98, 2014, pp. 25-43.

J107 Akram Hakiri, Pascal Berthoua, Aniruddha Gokhale, Douglas C. Schmidt, Gayraud Thierry, "Supporting SIP-based Data Distribution Service End-to-End QoS in WANs," the Elsevier Journal of Systems and Software, Volume 95, September 2014, pp. 100-121.

J106 Jules White, Douglas C. Schmidt, and Mani Golparvar-Fard, "Applications of Augmented Reality," IEEE Proceedings Special issue on Applications of Augmented Reality, Vol 102, No. 2., February 2014, pp. 120-123.

J105 Nickolas H. Guertin, Paul Bruhns, Douglas C. Schmidt, and Adam Porter, "Experiences Using Online War Games to Improve the Business of Naval Systems Acquisition," Cutter Journal of Information Technology Management, Vol. 27, No. 5, May 2014, pp 13-18.

J104 Michael McLendon, Bill Scherlis, and Douglas C. Schmidt, "Addressing Software Sustainment Challenges for the DoD," STSC CrossTalk, The Journal of Defense Software Engineering special issue on Legacy Systems Software, January, volume 27, number 1, 2014, pp. 27-32.

J103 Akram Hakiri, Pascal Berthoua, Aniruddha Gokhale, Douglas C. Schmidt, Gayraud Thierry, "Supporting End-to-end Scalability and Real-time Event Dissemination in the OMG Data Distribution Service over Wide Area Networks," Elsevier Journal of Systems and Software, volume 86, number 10, October, 2013, pp. 2574-2593.

J102 William Otte, Aniruddha Gokhale, and Douglas C. Schmidt, "Efficient and Deterministic Application Deployment in Component-based, Enterprise Distributed, Real-time, and Embedded

Systems," Elsevier Journal of Information and Software Technology, Vol. 55, No. 2, Feb 2013, 475-488.

J101 Dr. Douglas Schmidt, Anita Carleton, Erin Harper, Mary Ann Lapham, Ipek Ozkaya, and Linda Parker Gates, 'What Will It Take to Achieve Agility-at-Scale?", Cutter IT Journal, edited by Hillel Glazer, November 2012, pp. 34-39.

J100 Brian Dougherty, Jules White, and Douglas C. Schmidt, "Model-driven Auto-scaling of Green Cloud Computing Infrastructure," the Elsevier International Journal of Future Generation Computing Systems, Special Issue on Green Computing Systems, Volume 28, Number 2, February, 2012 Pages 371-378.

J99 Joe Hoffert, Douglas C. Schmidt, and Aniruddha Gokhale, "Evaluating Timeliness and Accuracy Trade-offs of Supervised Machine Learning for Adapting Enterprise DRE Systems in Dynamic Environments," the International Journal of Computational Intelligence Systems, Volume 4, Number 5, September-October 2011, pp. 806-816.

J98 James Hill, Pooja Varshneya, and Douglas C. Schmidt, "Evaluating Distributed Real-time and Embedded System Test Correctness using System Execution Traces," Central European Journal of Computer Science, Volume 1, Number 2, August 2011, pp. 167-184.

J97 Brian Dougherty, Jules White, and Douglas C. Schmidt, "Automated Software and Hardware Evolution Analysis for Distributed Real-time and Embedded Systems," the Central European Journal of Computer Science, Volume 1, Number 1, July 2011, pp. 36-57.

J96 James Hill, Hunt Sutherland, Paul Stodinger, Thomas Silveria, Douglas C. Schmidt, John Slaby, and Nikita Visnevski, "OASIS: An Architecture for Dynamic Instrumentation of Enterprise Distributed Real-time and Embedded Systems," the International Journal of Computer Systems Science and Engineering, Special Issue on Real-time Systems, Volume 26, Number 6, November 2011, pp. 413-430.

J95 Jules White, Brian Dougherty, Chris Thompson, Douglas C. Schmidt, "ScatterD: Spatial Deployment Optimization with Hybrid Heuristic/Evolutionary Algorithms," ACM Transactions on Autonomous and Adaptive Systems Special Issue on Spatial Computing, Volume 6 Issue 3, September 2011, 18:1-8:25.

J94 Jules White, Chris Thompson, Hamilton Turner, Brian Dougherty, and Douglas C. Schmidt, WreckWatch: Automatic Traffic Accident Detection and Notification with Smartphones, Journal of Mobile Networks and Applications, Volume 16 Issue 3, July 2011, Pages 285-303.

J93 Jules White, Brian Dougherty, Richard Schantz, Douglas C. Schmidt, Adam Porter, and Angelo Corsaro, "R&D Challenges and Solutions for Highly Complex Distributed Systems: a Middleware Perspective," the Springer Journal of Internet Services and Applications special issue on the Future of Middleware, Volume 2, Number 3, December 2011, pp. 1-8.

J92 Joe Hoffert, Aniruddha Gokhale, and Douglas C. Schmidt, "Autonomic Adaptation of Publish/Subscribe Middleware in Dynamic Environments," the International Journal of Adaptive, Resilient and Autonomic Systems (IJARAS), 2(4), 1-24, October-December 2011, pp. 1-24.

J91 Joe Loyall, Matt Gillen, Aaron Paulos, Larry Bunch, Marco Carvalho, James Edmondson, Douglas C. Schmidt, Andrew Martignoni, and Asher Sinclair, "Dynamic Policy-Driven Quality of Service in Service-Oriented Information Management Systems," Wiley journal on Software: Practice and Experience, December 2011, volume 41, number 12, pp. 1459-1489.

J90 Michael Stal, Douglas C. Schmidt, and Will Otte, "Efficiently and Transparently Automating Scalable On-demand Activation and Deactivation of Services with the Activator Pattern," Software: Practice and Experience, special issue on Pattern Languages: Addressing Challenges, Edited by Mohamed Fayad and Shivanshu Singh, volume 41, number 10, October 2011, Wiley and Sons, pp. 1-16.

J89 Brian Dougherty, Jules White, Douglas C. Schmidt, Russell Kegley, and Jonathan Preston, "Deployment Optimization for Embedded Flight Avionics Systems," STSC CrossTalk, The Journal of Defense Software Engineering, November/December, volume 24, number 6, 2011, pp. 1-8.

J88 Brian Dougherty, Daniel Guymon, Douglas C. Schmidt, and Jules White, "Overcoming Cellular Connectivity Limitations with M2Blue Autonomic Distributed Data Caching," Autonomic Computing for Computer Society of India Magazine, CSI Communications, August 2011, pp. 12-15.

J87 Friedhelm Wolf, Jaiganesh Balasubramanian, Sumant Tambe, Aniruddha Gokhale, and Douglas C. Schmidt, Supporting Component-based Failover Units in Middleware for Distributed Real-time and Embedded Systems, the Elsevier Journal of System Architectures (JSA): Embedded Systems Design, Special Issue on Real-time and Embedded Systems, May, 2011 pp. 597-613.

J86 Jules White, David Benavides, Douglas C. Schmidt, Pablo Trinidad, Antonio Ruiz-Cortes, Brian Doughtery, "Automated Diagnosis of Feature Model Configurations," The Journal of Systems and Software, Special Issue on Software Product-lines, Volume 83, Issue 7, July, 2010, pp. 1094-1107.

J85 Jules White, Brian Doughtery, and Douglas C. Schmidt, "ASCENT: An Algorithmic Technique for Designing Hardware and Software in Tandem, IEEE Transactions on Software Engineering Special Issue on Search-based Software Engineering, November/December 2010 (vol. 36 no. 6), pp. 838-851.

J84 Joe Hoffert, Daniel Mack, and Douglas Schmidt, "Integrating Machine Learning Techniques to Adapt Protocols for QoS-enabled Distributed Real-time and Embedded Publish/Subscribe Middleware," International Journal of Network Protocols and Algorithms (NPA): Special Issue on Data Dissemination for Large-scale Complex Critical Infrastructures, Volume 2, Number 3, 2010, pp. 37-69.

J83 James Hill, James Edmondson, Aniruddha Gokhale, and Douglas C. Schmidt, "Tools for Continuously Evaluating Distributed System Qualities," IEEE Software, July/August, 2010, Volume 27, Number 4, pp. 65-71.

J82 James Edmondson and Douglas C. Schmidt, Multi-Agent Distributed Adaptive Resource Allocation (MADARA), International Journal of Communication Networks and Distributed Systems (IJCNDS), Special Issue on: Grid Computing, Edited by Michal Wozniak and Krzysztof Walkowiak, Volume 5, Number 3, 2010, pp. 229-245.

J81 Jules White, Christin Groba, Sibohan Clarke, Brian Dougherty, Chris Thompson, and Douglas C. Schmidt, "R&D Challenges and Solutions for Mobile Cyber-Physical Applications and Supporting Internet Services," the Springer Journal of Internet Services and Applications, Volume 1, Number 1, 2010, pp. 45-56.

J80 Jules White, Jeff Gray, and Douglas C. Schmidt, "Constraint-based Model Weaving," Transactions on Aspect-Oriented Software Development, Special Issue on Aspects and Model Driven Engineering, eds. Robert France and Jean-Marc Jezequel, pp. 153-190, Volume 5560, Number 6, 2009.

J79 Jules White, Harrison Strowd, and Douglas C. Schmidt, "Creating Self-healing Service Compositions with Feature Modeling and Microrebooting," the International Journal of Business Process Integration and Management (IJBPIM), Special issue on Model-Driven Service-Oriented Architectures, Inderscience Publishers, pp. 35-46, Volume 4, Number 1, 2009.

J78 Nishanth Shankaran, John Kinnebrew, Xenofon Koutsoukos, Chenyang Lu, Douglas C. Schmidt, and Gautam Biswas, "An Integrated Planning and Adaptive Resource Management Architecture for Distributed Real-time Embedded Systems," IEEE Transactions on Computers, Special Issue on Autonomic Network Computing, Special Issue on Autonomic Network Computing, volume 58, number 11, pp. 1485-1498, November 2009.

J77 Jules White, Brian Doughtery, and Douglas C. Schmidt, "Selecting Highly Optimal Architectural Feature Sets with Filtered Cartesian Flattening," the Journal of Software and Systems, Special Issue on Design Decisions and Design Rationale in Software Architecture, Volume 82, Issue 8, pp. 1268-1284, August 2009.

J76 Jules White, James, Hill, Sumant Tambe, Jeff Gray, Aniruddha Gokhale, and Douglas C. Schmidt "Improving Domain-specific Language Reuse through Software Product-line Configuration Techniques, IEEE Software Special Issue: Domain-Specific Languages and Modeling, vol. 26, no. 4, pp. 47-53, July/August 2009.

J75 Jules White and Douglas C. Schmidt, "Automating Deployment Planning with an Aspect Weaver," IET Software Journal Special Issue on Domain-specific Aspect Languages, Volume 3, Issue 3 , p. 167-183, June 2009.

J74 Shanshan Jiang, Yuan Xue, and Douglas C. Schmidt, "Minimum Disruption Service Composition and Recovery in Mobile Ad Hoc Networks, Elsevier Computer Networks Journal, Special Issue on Autonomic and Self-Organizing Systems, Volume 53, Issue 10, Pages 1649-1665, 2009.

J73 Nishanth Shankaran, Douglas C. Schmidt, Xenofon D. Koutsoukos, Yingming Chen, and Chenyang Lu, "Design and Performance Evaluation of an Adaptive Resource Management Framework for Distributed Real-time and Embedded Systems," EURASIP Journal on Embedded Systems (EURASIP JES): Special issue on Operating System Support for Embedded Real-Time Applications, Edited by Alfons Crespo, Ismael Ripoll, Michael Gonzalez Harbour, and Giuseppe Lipari, 2008, Pgs. 47-66.

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J71 Nishanth Shankaran, Xenofon Koutsoukos, Chenyang Lu, Douglas C. Schmidt, and Yuan Xue, "Hierarchical Control of Multiple Resources in Distributed Real-time and Embedded Systems," the Springer Real-time Systems Journal, Volume 39, Numbers 1-3, August, 2008, pgs. 237-282.

J70 Douglas C. Schmidt, Angelo Corsaro, and Hans Van'T Hag, "Addressing the Challenges of Tactical Information Management in Net-Centric Systems with DDS," CrossTalk special issue on Distributed Software Development, pgs. 24-29, May 2008.

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2. "Website Applications Technology Overview," Digital Technologies in Cancer Research Workshop, Vanderbilt University, Nashville, TN, May 15th 2019.
3. "Producing and Delivering a Coursera MOOC on Pattern-Oriented Software Architecture for Concurrent and Networked Software," WaveFront forum at the SPLASH 2013 conference, Indianapolis, IN, October 29th, 2013.
4. "Addressing the Challenges of Tactical Information Management in Net-Centric Systems with the OMG Data Distribution Service (DDS)," the 16th International ACM Workshop on Parallel and Distributed Real-Time Systems (WPDRTS '08), Miami, Florida, April 14, 2008.
5. "The Design and Performance of Configurable Component Middleware for End-to-End Adaptation of Distributed Real-time Embedded Systems," proceedings of the 10th IEEE International Symposium on Object/Component/Service-oriented Real-time Distributed Computing (ISORC), May 7-9, 2007, Santorini Island, Greece.
6. "A Decision-Theoretic Planner for DRE Systems," 7th OMG Real-time/Embedded CORBA workshop, Arlington, VA, July 10–13, 2006.
7. "Model-driven QoS Provisioning for Real-time CORBA and CCM DRE Systems," 6th OMG Real-time/Embedded CORBA workshop, Arlington, VA, July 11–14, 2005.
8. "Research Advances in Middleware for Distributed Systems: State of the Art," Computer Communications stream of the 17th IFIP World Computer Congress, Montreal, Canada, August 25-30, 2002.
9. "Towards Highly Configurable Real-time Object Request Brokers," the IEEE International Symposium on Object-Oriented Real-time Distributed Computing (ISORC), Washington DC, April 29 – May 1, 2002.
10. "Operating System Performance in Support of Real-time Middleware," Proceedings of the 7th IEEE Workshop on Object-oriented Real-time Dependable Systems, San Diego, CA, January, 2002.
11. "Designing an Efficient and Scalable Server-side Asynchrony Model for CORBA," Proceedings of the ACM SIGPLAN Workshop on Optimization of Middleware and Distributed Systems (OM 2001), Snowbird, Utah, June 18, 2001.
12. "DOORS: Towards High-performance Fault-Tolerant CORBA," Proceedings of the 2nd International Symposium on Distributed Objects and Applications (DOA '00), OMG, Antwerp, Belgium, September 2000.
13. "The Design and Performance of a CORBA Audio/Video Streaming Service," Proceedings of the 31st Hawaii International Conference on System Systems (HICSS), Hawaii, January, 1999, minitrack on Multimedia DBMS and the WWW, Hawaii, January 1999.
14. "Alleviating Priority Inversion and Non-determinism in Real-time CORBA ORB Core Architectures," Proceedings of the Fourth IEEE Real-Time Technology and Applications Symposium (RTAS), Denver, Colorado, June 3-5, 1998
15. "Optimizing the Performance of the CORBA Internet Inter-ORB Protocol Over ATM," Proceedings of the 31st Hawaii International Conference on System Systems (HICSS), Hawaii, January, 1998. This was selected as the best paper in the Software Technology Track (188 submitted, 77 accepted).
16. "The Double-Checked Locking Pattern," *Proceedings of the 3rd annual Pattern Languages of Programming conference* in Allerton Park, Illinois, September 4-6, 1996.

17. "Acceptor and Connector: Design Patterns for Initializing Network Services," Proceedings of the EuroPLoP '96 conference, Kloster Irsee, Germany, July 10-14, 1996.
18. "Measuring the Performance of Communication Middleware on High-Speed Networks," Proceedings of SIGCOMM '96, ACM, San Francisco, August 28-30th, 1996.
19. "Design and Performance of an Object-Oriented Framework for High-Speed Electronic Medical Imaging," Proceedings of the 2^{nd} Conference on Object-Oriented Technologies and Systems (COOTS), USENIX, Toronto, June 18-22, 1996.
20. "A Family of Design Patterns For Flexibly Configuring Network Services in Distributed Systems," Proceedings of the International Conference on Configurable Distributed Systems, IEEE, Annapolis, Maryland, May 6-8, 1996.
21. "Using Design Patterns to Develop High-Performance Object-Oriented Communication Software Frameworks," Proceedings of the 8^{th} Annual Software Technology Conference, Salt Lake City, Utah, April 21-26, 1996.
22. "An Object-Oriented Framework for High-Performance Electronic Medical Imaging," Proceedings of the *Very High Resolution and Quality Imaging* mini-conference at the Symposium on Electronic Imaging in the International Symposia Photonics West 1996, SPIE, San Jose, California USA, January 27 - February 2, 1996.
23. "Half-Sync/Half-Async: A Pattern for Efficient and Well-structured Concurrent I/O," *Proceedings of the* 2^{nd} *Pattern Languages of Programs Conference* Monticello, Illinois, September 6-8, 1995.
24. "Acceptor and Connector: Design Patterns for Actively and Passively Initializing Network Services." Workshop on Pattern Languages of Object-Oriented Programs at ECOOP '95, August 7 – 1, 1995, Aarhus, Denmark.
25. "Object-Oriented Components for High-speed Network Programming," *Proceedings of the Conference on Object-Oriented Technologies (COOTS)*, USENIX, June 26-29, 1995 Monterey, California, USA, pp. 21–38.
26. "Experience Using Design Patterns to Evolve Communication Software Across Diverse OS Platforms," *Proceedings of the* 9^{th} *European Conference on Object-Oriented Programming (ECOOP)*, ACM, Aarhus, Denmark, August, 1995,.
27. "Measuring the Performance of Parallel Message-based Process Architectures," *Proceedings of the INFOCOM Conference on Computer Communications*, IEEE, Boston, MA, April, 1995, pp. 624–633.
28. "High-Performance Event Filtering for Dynamic Multi-point Applications," Proceedings of the 1^{st} Workshop on High Performance Protocol Architectures (HIPPARCH), INRIA, Sophia Antipolis, France, December, 1994, p 1–8.
29. "Flexible Configuration of High-Performance Object-Oriented Distributed Communication Systems," 9^{th} *OOPSLA Conference, invited paper to the Workshop on Flexibility in Systems Software*, ACM, Portland, Oregon, October, 1994, pp. 1–4.
30. "Performance Experiments on Alternative Methods for Structuring Active Objects in High-Performance Parallel Communication Systems," 9^{th} *OOPSLA Conference, poster session*, ACM, Portland, Oregon, October, 1994, pp. 1–12.
31. "Measuring the Impact of Alternative Parallel Process Architectures on Communication Subsystem Performance," *Proceedings of the Proceedings of the* 4^{th} *International Workshop on Protocols for High-Speed Networks*, IFIP, Vancouver, British Columbia, August, 1994, pp. 103–118.
32. "Reactor: An Object Behavioral Pattern for Concurrent Event Demultiplexing and Dispatching," *Proceedings of the* 1^{st} *Annual Conference on the Pattern Languages of Programs*, Monticello, Illinois, August, 1994, pp. 1–10.
33. "Experiences with an Object-Oriented Architecture for Developing Dynamically Extensible Network Management Software," *Proceedings of the Globecom Conference*, IEEE, San Francisco, California, November, 1994, pp. 1–7.
34. "Configuring Function-based Communication Protocols for Distributed Applications," *Proceedings of the* 8^{th} *International Working Conference on Upper Layer Protocols, Architectures, and Applications*, IFIP, Barcelona, Spain, June 1-3, 1994, pp. 361–376.

35. "The ADAPTIVE Service Executive: An Object-Oriented Architecture for Configuring Concurrent Distributed Communication Systems," *Proceedings of the* 8^{th} *International Working Conference on Upper Layer Protocols, Architectures, and Applications*, IFIP, Barcelona, Spain, June 1-3, 1994, pp. 163–178.
36. "ASX: An Object-Oriented Framework for Developing Distributed Applications," *Proceedings of the* 6^{th} *C++ Conference*, USENIX, Cambridge, Massachusetts, April, 1994, pp. 200–220.
37. "The Service Configurator Framework: An Extensible Architecture for Dynamically Configuring Concurrent, Multi-service Network Daemons," *Proceedings of the* 2^{nd} *International Workshop on Configurable Distributed Systems*, IEEE, Pittsburgh, PA, March 21-23, 1994, pp. 190–201.
38. "Tools for Generating Application-Tailored Multimedia Protocols on Heterogeneous Multi-Processor Platforms," *Proceedings of the* 2^{nd} *Workshop on High-Performance Communications Subsystems*, IEEE, Williamsburg, Virginia, September 1-3, 1993, pp. 1–7.
39. "A Framework for Developing and Experimenting with Parallel Process Architectures to Support High-Performance Transport Systems," *Proceedings of the* 2^{nd} *Workshop on High-Performance Communications Subsystems*, IEEE, Williamsburg, Virginia, September 1-3, 1993, pp. 1–8.
40. "ADAPTIVE: a Framework for Experimenting with High-Performance Transport System Process Architectures," *Proceedings of the* 2^{nd} *International Conference on Computer Communications and Networks*, ISCA, San Diego, California, June 28-30, 1993, pp. 1–8.
41. "ADAPTIVE: A Flexible and Adaptive Transport System Architecture to Support Lightweight Protocols for Multimedia Applications on High-Speed Networks," *Proceedings of the* 1^{st} *Symposium on High Performance Distributed Computing*, IEEE, Syracuse, New York, September 9-11, 1992, pp. 174–186.
42. "GPERF: A Perfect Hash Function Generator," *Proceedings of the* 2^{nd} *C++ Conference*, USENIX, San Francisco, California, April 9-11, 1990, pp. 87–102.

Invited Talks

1. "Architecting the Systems of the Future: A Research Agenda," invited keynote talk at the Doctoral Symposium for the 22nd ACM/IFIP International Conference on Middleware, December 6th, 2021.
2. "Cyber- and Physical-Security Risks," Southern Illinois University course on Domestic Terrorism, July 22nd, 2021.
3. "Architecting the Future of Software Engineering," invited keynote talk at the 16th International Conference on Software Technologies, July 8th, 2021.
4. "Challenges of Certifying Adaptive Dynamic Computing Environments," ARLIS Workshop, January 28th, 2021.
5. "Cyber-Security and You: Practicing Safe Surfing on the Internet," the National Active and Retired Federal Employees (NARFE) chapter, Nashville TN, January 13th, 2021.
6. "Challenges of Certifying Adaptive Dynamic Computing Environments," DARPA/SEI Software Engineering Grand Challenges and Future Visions Workshop, December 1st, 2020.
7. "Surveillance Capitalism and You," invited talk at the Southeast Science Boot Camp, Nashville, TN, May 29th, 2019.
8. "Diversify Sponsorship of Your Research: Getting Funding from the Department of Defense," Office of Research Development and Support Workshop, October 22nd, 2018, Nashville, TN.
9. "Surveillance Capitalism and You," invited talk at the Memorizing the Future: Collecting in the 21st Century Conference, Nashville, TN, October 6th, 2018.
10. "Aligning Incentives to Enable More Effective Organic Software Infrastructure for the DoD," DoD Organic Software Infrastructure Workshop, Arlington VA, August 13th, 2018.
11. "The Blockchain: What It is and Why It Matters to Us," Transforming Dermatology in the Digital Era, Memorial Sloan Kettering Cancer Center, October 25, 2018, NY, NY, USA.
12. "Aligning Incentives to Enable Modular Open Software for DoD Combat Systems," Modular Open Systems Summit, May 1st, 2018, Washington DC.

13. "The Blockchain: What It is and Why It Matters to Us," Society of Women Engineers, Vanderbilt University, March 14th, 2018.
14. "The Blockchain: What It is and Why It Matters to Us," Invited keynote at the Workshop on Middleware and Applications for the Internet of Things, (co-located with the 2017 Middleware conference in Las Vegas, USA), December 11th and 12th, 2017.
15. "The Blockchain: What It is and Why It Matters," Vanderbilt University, Nashville, TN, November 28th, 2017.
16. "The Blockchain: What It is and Why It Matters," INTERFACE Nashville conference, Nashville, TN, August 24th, 2017.
17. "Applying Blockchain to Healthcare Systems," panel presentation at the Siemens Blockchain Conference, Nuremburg, Germany, May 10th, 2017.
18. "A Primer on Big Data," Vanderbilt University Board of Trust meeting, April 21st, 2017, Nashville TN.
19. "The Past, Present, and Future of MOOCs and Their Importance for Software Engineering," Distinguished Lecture, University of Illinois Chicago, Chicago, IL, November 18th, 2016.
20. "Agility-at-Scale for Safety- and Mission-Critical Industrial-Scale Systems," INFORMS Annual Conference, Nashville, TN November 13th, 2016.
21. "Product Line Architectures for Open System Architectures," Varian, Winnipeg, Canada, October 7th, 2016.
22. "Agility-at-Scale for Safety- and Mission-Critical Industrial-Scale Systems," Siemens Architecture Workshop, Tarrytown, NY, September 27th, 2016.
23. "Product Line Architectures for Oncology Treatment Services," Varian, Palo Alto, CA, September 16th, 2016.
24. "Innovation and Speed: The Rise of Open Systems," the United States Technology Leadership Council, Reston, VA, August 24th, 2016.
25. "Elastic Software Infrastructure to Support the Industrial Internet," the Siemens CPS Workshop, Munich, Germany, August 1st, 2016.
26. "Challenges of Certifying Adaptive Dynamic Computing Environments," Workshop on Safety And Control for AI, Sponsored by the White House Office of Science and Technology Policy and Carnegie Mellon University, Pittsburgh, PA, June 28th, 2016.
27. "Keeping an Unfair Advantage in a Globalized and Commoditized World," Raytheon Symposium, Tucson, AZ, May 5th, 2016.
28. "Towards Technical Reference Frameworks to Support Open System Architecture Initiatives," Office of the Secretary of Defense (OSD) System of Systems Engineering Collaborators Information Exchange, December 15th 2015.
29. "Enterprise System of Systems Engineering (SoSE) Integration and Innovation," presentation at the US Marine Corp Business Management Association meeting, Quantico, VA, December 10th, 2015.
30. "An Architecture Grand Challenge: DOD's push for Open Systems Architecture," panel presentation at the Software Solutions Conference, Crystal City, VA, November 17th, 2015.
31. "Elastic Software Infrastructure to Support the Industrial Internet," the Siemens CPS Workshop, Munich, Germany, September 29th, 2015.
32. "An Overview of Mobile and mHealth Activities at ISIS and Vandy EECS," Patient Engagement Emerging Technologies, Vanderbilt University, Nashville, TN, August 10, 2015.
33. "Mobile Cloud Computing with Android," Google I/O, Mercury Intermedia Systems, Nashville, TN, May 28th, 2015.
34. "An Architecture Grand Challenge: DOD's push for Open Systems Architecture," panel presentation at the SATURN 2015 Conference, Baltimore, MD, April 27th, 2015.
35. "'Elastic Software Infrastructure to Support Computing Clouds for Cyber-Physical Systems," Distinguish Lecture, Texas A&M, April 27th, 2015.

36. "Elastic Software Infrastructure to Support Computing Clouds for Cyber-Physical Systems", Boeing Distinguished Researcher And Scholar Seminar (B-DRASS) series, March 20th, Huntingon Beach, CA.
37. "Elastic Software Infrastructure to Support Computing Clouds for Cyber-Physical Systems," Distinguished Lecture, University of California, Irvine, February 27th, 2015.
38. "Elastic Software Infrastructure to Support Computing Clouds for Cyber-Physical Systems," Varian, Palo Alto, CA, January 15th, 2015.
39. "Keeping an Unfair Advantage in a Globalized and Commoditized World," Open Architecture Summit, Washington DC, November 4th, 2014.
40. "Proposal for a Professional Masters degree in Computer Science," invited talk at Vanderbilt University School of Engineering's Board of Visitor's meeting, October 10th, 2014.
41. "The Past, Present, and Future of Open System Architecture Initiatives," invited keynote at the Future Airborne Capabilities Environment meeting, Nashville, TN, September 24th.
42. "Future Proofing Research and Development Investments in a Globalized, Commoditized World," Boeing Technical Excellence Conference, May 20th, 2014, St. Louis, MO.
43. "Elastic Software Infrastructure to Support the Computing Clouds for Cyber-Physical Systems (CC4CPS)," Securboration Conference, November 12th, 2013, Melbourne, Florida.
44. "The Importance of Automated Testing in Open Systems Architecture Initiatives," Open Architecture Summit, November 12th, 2013, Washington DC.
45. Conference on Cloud and Mobile Computing, Siemens Corporate Research, Princeton, NJ, November 5th, 2013.
46. "Overview of the Technology Entrepreneurship Task Force," Innovation, Imagination, and Introductions: A Conversation with Entrepreneurs, Vanderbilt University, October 24th, 2013.
47. "Producing and Delivering a Coursera MOOC on Pattern-Oriented Software Architecture for Concurrent and Networked Software," Vanderbilt University's Faculty Senate committee on Strategic Planning and Academic Freedom, October 23rd, 2013.
48. "Elastic Software Infrastructure to Support the Industrial Internet," RTI Webinar series, October 23rd, 2013.
49. "The Importance of Applying Agility to DoD Software Initiatives," IEEE Computer Society Lockheed Martin webinar series, October 10th, 2013.
50. "Technology Entrepreneurship Task force: Charter and Progress Update," Vanderbilt University School of Engineering Board of Visitors meeting, October 4th, 2013.
51. "Stochastic Hybrid Systems Modeling and Middleware-enabled DDDAS for Next-generation USAF Combat Systems," AFOSR DDDAS PI meeting, Arlington, VA, October 1st, 2013.
52. "Producing and Delivering a Coursera MOOC on Pattern-Oriented Software Architecture for Concurrent and Networked Software," WithIT seminar, Vanderbilt University, September 12th, 2013.
53. "Applying Agility to the US Department of Defense Common Operating Platform Environment Initiatives," Interoperable Open Architecture conference, Washington DC, September 11th, 2013.
54. "Software Infrastructure Support of Computing Clouds for Cyber-Physical Systems," invited talk at Real-Time Innovations, July 31st, 2013, Sunnyvale, California.
55. "Introduction to the Institute for Software Integrated Systems," Nashville Entrepreneur Center, July 15th, 2013.
56. "Surviving the Coursera Digital Learning Experience," Coursera-in-TN Conference, Vanderbilt University, Nashville, TN, June 24th, 2013.
57. "Quo Vadis ISORC?," Panel presentation at ISORC 2013 Conference, June 19th, 2013, Paderborn, Germany.
58. "Software Infrastructure Support of Computing Clouds for Cyber-Physical Systems," invited keynote for ISORC 2013 Conference, June 19th, 2013, Paderborn, Germany.
59. "Towards Programming Models and Paradigms for Computing Clouds that Support Cyber-Physical Systems," NSF Workshop on Computing Clouds for Cyber-Physical Systems, March 15th, 2013, Ballston, VA.

60. "Built to Last: Planning Your Career as an Engineer," STEM contest on Securing Cyber Space, Brentwood High School, March 9th, 2013, Nashville, TN.
61. "Experience with Digital Learning and MOOCs at Vanderbilt," Nashville, TN, Feb 22nd, 2013.
62. "Software Design: Is It Really Better to Look Good Than to Feel Good?," World IA Day, Nashville, TN, Feb 9th, 2013.
63. "Pattern-Oriented Software Architectures: Patterns and Frameworks for Concurrent and Networked Software," PhreakNIC 2012, Murfreesboro, TN, November 9th, 2012.
64. "Applying Agility to the US Department of Defence Common Operating Platform Environment Initiatives," Interoperable Open Architecture 2012, 29 - 31 October, 2012, London, UK.
65. "Open System Architectures: Challenges and Success Drivers," OA Summit conference, Washington, DC, October 18th, 2012.
66. "Dependable Computing Clouds for Cyber-Physical Systems," Dependability Issues in Cloud Computing Workshop, October 11th, 2012, Irvine, CA.
67. "Computing Clouds for Cyber-Physical Systems," Reliable Cloud Infrastructure for CPS Applications Workshop, October 8th, 2012, Irvine, CA.
68. "Common Operating Platform Environments: Challenges and Success Drivers," Navy Open Systems Architecture workshop, Ballston, VA, September 27th, 2012.
69. "Meeting the Challenges of Enterprise Distributed Real-time and Embedded Systems," talk for Honeywell Aerospace, September 21, 2012.
70. "Architecture-Led Iterative and Incremental Development for Common Operating Platform Environments," NITRD Software Design and Productivity meeting, National Coordination Office, Ballston, VA, July 13th, 2012.
71. "Cyber-physical multi-core Optimization for Resource and cachE effectS," Software-Intensive Systems Producibility workshop, Arlington VA, June 5th, 2012.
72. "Applying Agility to DoD Common Operating Platform Environment Initiatives", SEI Agile Research Forum, May 22nd, 2012.
73. "Meeting the Challenges of Enterprise Distributed Real-time and Embedded Systems," keynote talk at the SATURN Conference 2012 May 7-11, 2012, St. Petersburg, FL.
74. "Reflections on 20 Years of Architecture for Distributed Real-time and Embedded Systems," SATURN Conference 2012 May 7-11, 2012, St. Petersburg, FL.
75. "US Naval Open Systems Architecture Strategy," SATURN Conference 2012 May 7-11, 2012, St. Petersburg, FL.
76. "Towards Open Systems Architectures for Distributed Real-time and Embedded Systems," The Center for Embedded Systems for Critical Applications, Annual Workshop, Virginia Tech, Blackburg, VA April 21st, 2012.
77. "Overview of the SEI Strategic Research Plan," ASD(R&E) Annual Program Review, December 7th, 2011, Pittsburgh, PA.
78. "Overview of the SEI Strategic Research Plan," Acquisition Support Program meeting, November 16th, 2011, Pittsburgh, PA.
79. "Conducting Leading-Edge Software R&D in a Globalized, Commoditized World," NITRD Software Design and Productivity meeting, National Coordination Office, Ballston, VA, November 3rd, 2011.
80. "A Technical Assessment of Open Architecture Systems for Military Use," Interoperable Open Architecture, 26th-28th October 2011, London, UK.
81. "Conducting Leading-Edge Software R&D in a Globalized, Commoditized World," Technovation 2011, Carnegie Mellon University, September 29th, 2011.
82. "CTO Report," SEI Board of Visitors Meeting, Arlington, VA, September 27th, 2011.
83. "Overview of the SEI Strategic Research Plan," Joint Advisory Committee Meeting, Arlington, VA, September 26th, 2011.

84. "Successful Development Efforts: Standards, People, & Culture: The Enterprise Perspective," Software Assurance (SwA) Forum, September 16th, 2011, Arlington, VA.
85. "Ultra-Large-Scale (ULS) Cyberphysical Systems and Their Impact on Technology and Society," University of Salzburg, June 30th, 2011, Salzburg, Austria.
86. "Ultra-Large-Scale (ULS) Cyberphysical Systems and Their Impact on Technology and Society," ARTEMIS conference, June 29th, 2011, Linz, Austria.
87. "Ultra-Large-Scale Systems and Their Impact on the DoD," Systems and Software Technology Conference Committee, keynote presentation at the 23rd Systems and Software Technology Conference, May 16-19, 2011, Salt Lake City, Utah.
88. "Ultra-Large Scale Systems and their Impact on Technology and Society," keynote presentation at the International Symposium on Object-Oriented Real-time Distributed Computing¡/A¿ (ISORC), Newport Beach, CA, March 29th, 2011.
89. "Software-reliant Systems Research at the Software Engineering Institute," Raytheon, Sudbury, MA, March 10, 2011.
90. "Review of COE Practices," US Army Senior Leadership Education Program, Pittsburgh, PA, January 20th, 2011.
91. "Software Producibility for Defense," US Army Senior Leadership Education Program, Pittsburgh, PA, January 18th, 2011.
92. "SEI Research: The Shape of Things to Come," ASP Meeting, Software Engineering Institute, Pittsburgh, PA, December 9th, 2010.
93. "R&D at ASP," ASP Air Force Training Day, Software Engineering Institute, Pittsburgh, PA, December 9th, 2010.
94. "Software-reliant Systems Research at the Software Engineering Institute," Siements Corporate Research, Princeton, NJ, November 22nd, 2010.
95. "Taming the Complexity of Software-Reliant Systems," Software Engineering Process Group conference, Colombia, South America, November 11th, 2010.
96. "SEI Technical Presentations," Joint Advisory Committee Meeting, Arlington, VA, October 26th, 2010.
97. "SEI Research: The Shape of Things to Come," ASP Meeting, Software Engineering Institute, Pittsburgh, PA, October 20th, 2010.
98. "SEI Research: The Shape of Things to Come," SEPM Meeting, Software Engineering Institute, Pittsburgh, PA, October 19th, 2010.
99. "Strategic Directions for Research at the SEI," RTSS Offsite Meeting, Pittsburgh, PA, October 12th, 2010.
100. "The World is Flat and What You Can Do About It," Family Weekend, October 9th, 2010, Vanderbilt University.
101. "SEI Research: The Shape of Things to Come," SEI Board of Visitor's Meeting, Arlington, VA, September 28th, 2010.
102. "SEI Research: The Shape of Things to Come," PD&T Meeting, Software Engineering Institute, Pittsburgh, PA, September 20th, 2010.
103. "Introduction and Initial Thoughts," RTSS Meeting, Software Engineering Institute, Pittsburgh, PA, August 19th, 2010.
104. "The Impact of Ultra-Large-Scale Systems on DoD Operations," Congressional R&D Caucus, Rayburn Building, Washington DC, January 19th, 2010.
105. "The World is Flat and What You Can Do About It," Explorers meeting, January 12th, 2010, Vanderbilt University.
106. "Expectations for University - Industry Collaborative Research in CPS," Computing Community Consortium Workshop on New Forms of Industry-Academy Partnerships in CPS Research, George Mason University, May 19th, 2009.
107. "How Good is Your SOA?", Panel presentation at the AFRL QED PI meeting, April 28th, 2009, Washington DC.

108. "The World is Flat and What You Can Do About It," ES 140, Computer Science module, October 31st, 2008, Vanderbilt University.
109. "Meeting the Challenges of Ultra-Large-Scale Distributed Real-time and Embedded Systems with QoS-enabled Middleware and Model-Driven Engineering," Panel on Growing and Sustaining Ultra Large Scale (ULS) Systems, OOPSLA 2008, Nashville TN, October 21-23 2008.
110. "The World is Flat and What You Can Do About It," Family Weekend Faculty Lecture, Vanderbilt University, October 3rd, 2008.
111. "The World is Flat and What You Can Do About It," Senior Design Seminar, Vanderbilt University, September 17th, 2008.
112. "The World is Flat and What You Can Do About It," CS WithIT Seminar, Vanderbilt University, September 11th, 2008.
113. "The Managed Motorway: Real-time Vehicle Scheduling - A Research Agenda," Qualcomm, July 28th, 2008, San Diego, CA.
114. "Meeting the Challenges of Mission-Critical Distributed Event-Based Systems with QoS-enabled Middleware and Model-Driven Engineering," 2nd International Conference on Distributed Event-Based Systems (DEBS), Rome Italy, July 2-4, 2008.
115. "Meeting the Challenges of Distributed Real-time and Embedded Systems with QoS-enabled Middleware and Model-Driven Engineering," SPAWAR, April 29th, 2008.
116. "Meeting the Challenges of Distributed Real-time and Embedded Systems with QoS-enabled Middleware and Model-Driven Engineering," Northrop Grumman, Boulder Colorado, April 25th, 2008.
117. "Experimentation Environment for QED," AFRL Information Management PI Meeting, April 16 2008, Georgetown, Washington, DC.
118. "Adaptive System Infrastructure for Ultra-Large-Scale Systems," SMART Conference, Carnegie Mellon University, March 6th, 2008.
119. "Experimentation Environment for QED", Air Force Research Lab, Rome, NY, March 4th, 2008.
120. "Ultra-Large-Scale (ULS) Systems and their Impact on Technology and Society," Clemson University, January 31st, 2008.
121. "Meeting the Challenges of Ultra-Large-Scale Distributed Real-time and Embedded Systems with QoS-enabled Middleware and Model-Driven Engineering, invited keynote talk at Middleware 2007, Irvine, CA, November 29th, 2007.
122. "The World is Flat and What You Can Do About It," Senior Design Seminar, Vanderbilt University, November 14th, 2007.
123. "Technology Candidates for QED," AFRL retreat, Minnowbrook, NY, October 23, 2007.
124. "Overview of ISIS and Proposed IU/CRC R&D Projects," Crystal City, VA, October 19th, 2007.
125. The Future of CORBA for Distributed Real-time and Embedded Systems, International Conference on Accelerator and Large Experimental Physics Control Systems, October 17, 2007, Knoxville, TN.
126. "AF-TRUST: Project Overview," Air Force Scientific Advisory Board review, Rome, NY, October 15th, 2007.
127. "Meeting the Challenges of Distributed Real-time and Embedded Systems with Product-Line Architectures," August 1st, 2007, Trinity College, Dublin, Ireland.
128. "Model Driven Engineering of Product-Line Architectures for Distributed Real-time and Embedded Systems," July 5th, 2007, University of Limerick, Ireland.
129. "Meeting the Challenges of Mission-Critical Systems with Middleware and Model Driven Engineering", OMG Technical Meeting, June 27, 2007, Brussels, Belgium.
130. Meeting the Challenges of Ultra-Large-Scale Distributed Real-time and Embedded Systems with Model-Driven Engineering, June 19, 2007, Trinity College, Dublin.
131. Strategic Technology Positioning, PrismTechnologies "Middleware Fest", June 14, 2007, Newcastle, UK.
132. "Hurdles for Wireless Communication Systems R&D and Some Ways to Overcome Them," OSD Workshop on Wireless Communication Systems, Rosslyn, VA, May 22nd, 2007.

133. "The World is Flat from a Computer Scientists Point of View," Vanderbilt University Commencement talk, May 10th, 2007.
134. Meeting the Challenges of Ultra-Large-Scale Distributed Real-time and Embedded Systems, invited keynote at the the 10th IEEE International Symposium on Object/Component/Service-oriented Real-time Distributed Computing, May 7-9, 2007, Santorini Island, Greece.
135. "Enhanced QoS for the GIG," AFRL JBI PI meeting, Georgetown, DC, April 24, 2007.
136. "Meeting the Challenges of Ultra-Large-Scale Distributed Real-time and Embedded Systems," Invited keynote at the 15th International Workshop on Parallel and Distributed Real-Time Systems (WDPRTS), March 26-27, 2007, Long Beach, California.
137. "The CORBA C++ Mapping: Beyond Repair?," OMG Meeting, San Diego, CA, March 27th, 2007.
138. "Meeting the Challenges of Ultra-Large-Scale Systems via Model-Driven Engineering," Distinguished Lecturer Series, Florida International University, Miami, Florida, Feb 2, 2007.
139. Model Driven Engineering and QoS-enabled Component Middleware for DRE Systems, Invited talk at the European Space Agency Operations Center, Darmstadt, Germany, Wednesday January 24, 2007.
140. "Software Wind Tunnel (SWiT) Concept of Operations and System Architecture", AFRL Software and Systems Test Track workshop, Arlington, VA, January 19, 2007.
141. "Latest Breakthroughs in SDR Software Development Using Model Driven Technologies," Rockwell Collins, Cedar Rapids, IA, December 14th, 2006.
142. "Educating the DoD Workforce in a Flat World," 2006 Raytheon Integrated Defense Systems' SW Engr. Directorate Off-Site Meeting, New Castle, New Hampshire, December 7, 2006.
143. "The Ultra Challenge: Software Systems Beyond Big," panelist at OOPSLA 2006, October, 2006, Portland, OR.
144. "Software Wind Tunnel (SWiT) Architecture," AFRL Software and Systems Test Track Workshop, Cherry Hill, NJ, October 2nd, 2006.
145. "The World is Flat and What You Can Do About it," Vanderbilt University, September 12th, 2006.
146. "The World is Flat and What You Can Do About it," Vanderbilt University, September 8th, 2006.
147. "Meeting the Challenges of Ultra-Large-Scale Systems via Model-Driven Engineering," Network-Centric Operations Industry Consortium, Reston, VA, August 2nd 2006.
148. Model Driven Architecture Roundtable, invited panelist at the Software Engineering Institute, Pittsburgh, PA, June 1st, 2006.
149. "Enhanced QoS for the GIG," AFRL JBI PI meeting, Tysons Corner, VA, April 11, 2006.
150. "Model Driven Engineering for Distributed Real-time and Embedded Systems," Distinguished Lecturer Series talk at Colorado State University, Ft. Collins, CO, April 10, 2006.
151. "Win-Win Partnership of Academia and Industry: Why Should We Care? Where Is Our Common Future?" invited panelist at the 12th IEEE Real-Time and Embedded Technology and Applications Symposium April 6, 2006, San Jose, California.
152. "Meeting the Challenges of Ultra-Large-Scale Real-time Systems," invited keynote at the IEEE Real-Time and Embedded Technology and Applications Symposium April 5, 2006, San Jose, California.
153. "Model-driven Development for Distributed Real-time and Embedded Systems," ACM Meeting at Middle Tennessee State University, March 7th, 2006.
154. "Real-time, Scalable, and Secure Information Management for the GIG," Scientific Advisory Board Meeting, Rome, NY, November 16th, 2005.
155. "Real-time, Scalable, and Secure Information Management for the GIG," Airforce Research Lab, Rome, NY, November 3rd, 2005.
156. "Model-driven Development for Distributed Real-time and Embedded Systems," Distinguished Speaker Talk at BBN Technologies, Cambridge, MA, October 27, 2005.

157. "Challenges and Research Areas for QoS-enabled Information Management in Tactical Systems of Systems," AFRL Minnowbrook Workshop, Adirondack Mountains, NY, October 21st, 2005.
158. "Model-driven Development for Distributed Real-time and Embedded Systems," Invited keynote at MODELS 2005, ACM/IEEE 8th International Conference on Model Driven Engineering Languages and Systems, Half Moon Resort, Montego Bay, Jamaica, October 5-7, 2005.
159. "The World is Flat and What You Can Do About it," CS WithIT Seminar, Vanderbilt University, September 22, 2005.
160. "Why Software Reuse has Failed and How to Make it Work for You," Motorola 2005, Symposium on Software, Systems, and Simulation, Schaumburg, IL, September 16th, 2005.
161. "Pattern-Oriented Software Architecture," 12th Pattern Language of Programming Conference, Allerton Park, Illinois, September 7-10, 2005.
162. "Model-Driven Development of Distributed Real-time and Embedded Systems," 12th Pattern Language of Programming Conference, Allerton Park, Illinois, September 7-10, 2005.
163. "Model-driven Development for Distributed Real-time and Embedded Systems," Siemens Corporate Research, Princeton, NJ, August 26th.
164. "Model-driven QoS Provisioning for Real-time CORBA and CCM DRE Systems," 6th OMG Real-time/Embedded CORBA workshop, Washington DC, July 11–14, 2005.
165. "A Proposed R&D Agenda for the Software Technology Laboratory," Lockheed Martin Advanced Technology Lab, Cherry Hill, NJ, June 28th, 2005.
166. "Model-Driven Development of Product-Line Architectures for DRE Systems," 11th Siemens Software Architecture Improvement Group (SAIG), Buffalo Grove, IL June 22, 2005.
167. "Business Drives for Platforms," panel at the 11th Siemens Software Architecture Improvement Group (SAIG), Buffalo Grove, IL June 22, 2005.
168. "Model Driven Development for Distributed Real-time and Embedded Systems," Lockheed Martin Advanced Technology Lab, Cherry Hill, NJ, June 15th, 2005.
169. "Approaches for Supporting Real-time QoS in JBI," JBI PI Meeting, Washington DC, May 24th, 2005.
170. "Overcoming Hurdles of Software Producibility," OSD, Software Producibility Workshop, Arlington, VA, May 18, 2005.
171. "Overview of Multi-Level Resource Management in ARMS," Fermilab, Chicago, IL, April 12th, 2005.
172. "Model Driven Middleware for Distributed Real-time and Embedded Systems," University of Southern Alabama, April 8, 2005.
173. "Model-Driven Development of Distributed Real-time and Embedded Systems," UAV Battlelab, Indian Springs, NV, February 10th, 2005.
174. "The Future of Software and Systems Engineering," IEEE Meeting, Vanderbilt University, February 8th, 2005.
175. Model Driven Development of Distributed Real-time and Embedded Systems, panel at the OOP conference, Munich, Germany, January 27, 2005.
176. "Product-line Architecture Technologies for Distributed Real-time and Embedded Systems, Lockheed Martin, Moorestown, NJ, November 11, 2004.
177. "Model Driven Development of Distributed Real-time and Embedded Systems," invited panelist in the "Generative Programming: Past, Present, and Future," at the 3rd ACM International Conference on Generative Programming and Component Engineering, Vancouver, CA, October 24th 2004.
178. "Developing Combat Systems with Component Middleware and Models," Lockheed Martin, Moorestown, NJ, October 22, 2004.
179. "Model Driven Development of Distributed Real-time and Embedded Systems," Lockheed Martin Advanced Technology Lab, Cherry Hill, NJ, October 21, 2004.
180. "Model Driven Development of Distributed Real-time and Embedded Systems," Lockheed Martin Missile and Fire Control, Dallas, TX, October 13, 2004.

181. "Design of ARMS MLRM Components: CCM Based Design for Dynamic Resource Management," DARPA ARMS Technical Interchange Meeting, Plymouth, RI, October 7, 2004.
182. "Model Driven Middleware for Component-based Distributed Systems," keynote for the The 8th International IEEE Enterprise Distributed Object Computing Conference, Monterey, California, September 22, 2004.
183. "Systems Science Challenge Area," TRUST NSF Science and Technology Review, UC Berkeley, September 12, 2004.
184. "Model Driven Development for Distributed Real-time and Embedded Systems," Lockheed Martin, Eagan, MN, August 31st, 2004.
185. "Model Driven Computing for Distributed Real-time and Embedded Systems," Telcordia, Piscataway, NJ, August 10th, 2004.
186. "Model Driven Computing for Distributed Real-time and Embedded Systems," Raytheon, Portsmouth, RI, August 9th, 2004.
187. "Distributed Object Computing with CORBA," Raytheon, Portsmouth, RI, August 9th, 2004.
188. "Model Driven Development of Distributed Real-time and Embedded Systems," Raytheon, Ft. Wayne, IN, July 27th, 2004.
189. "Model Driven Middleware for Distributed Real-time and Embedded Systems," panelist at the 5th OMG Real-time and Embedded Middleware Workshop, Reston, VA 2004.
190. "The Role of Open Standards,Open-Source Development, and Different Development Models and Processes on Industrializing Software," ARO Workshop on Software Reliability for FCS, Vanderbilt University, Nashville, Tennessee, May 18-19, 2004.
191. "Model Driven Middleware for Distributed Real-time and Embedded Systems," Keynote talk for the SIGS Software Engineering Today conference in Zurich, Switzerland, May 4-5, 2004.
192. "Model-Driven Development of Distributed Real-time and Embedded Systems," 10th Siemens Software Architecture Improvement Group (SAIG), Vienna, Austria, April 20-24, 2004.
193. "Adaptive and Reflective Middleware for Distributed, Real-time, and Embedded Systems," Purdue University, West Lafayette, Indiana, April 6, 2004.
194. "Model Driven Middleware for Distributed Real-time and Embedded Systems," *Technologies That Will Change the World* session at the Southeastern Software Engineering Conference, Huntsville, Alabama, March 30th, 2004.
195. "Advances in COTS Middleware for Distributed Real-time and Embedded Systems," Keynote for the International Conference on COTS-Based Software Systems (ICCBSS) 2004 in Redondo Beach, February 2-4, 2004.
196. Composable Middleware Components for High Confidence Network Embedded Systems, University of California, Berkeley, December 4th, 2003.
197. "Model Driven Middleware," TechConnect 2003, St. Louis, MO, October 1st, 2003.
198. "Advances in Model Driven Middleware for Distributed Real-time and Embedded Systems," the Model Integrated Computing PSIG meeting at the OMG Technical Meeting, September 10, 2003, Boston, MA.
199. Invited panelist for the "Research on DRE Systems" panel at the OMG Real-time Middleware Workshop, July 16, 2003, Arlington, VA.
200. "Advances in Model Driven Middleware for Distributed Real-time and Embedded Systems," the OMG Real-time Middleware Workshop, July 15, 2003, Arlington, VA.
201. Organizer and presenter for a panel on "Advances in Large-scale Distributed Real-time and Embedded Systems" at the 9th IEEE Real-time/Embedded Technology and Applications Symposium (RTAS), May 27-30, 2003, Washington, DC.
202. "Managing Project Risk for Combat Systems," The Southeastern Software Engineering Conference, Huntsville, Alabama, April 1st, 2003.
203. "Distributed Real-time and Embedded Systems at DARPA," OMG Workshop on Super Distributed Objects, Washington DC, Monday, November 18, 2002.

204. "Adaptive and Reflective Middleware for Distributed Real-time Systems," Workshop on High Performance, Fault Adaptive, Large Scale Real-time Systems, Vanderbilt University, November 14, 2002.
205. Invited panelist on "Objects and Real-time Systems" OOPSLA '02, Seattle, WA, November 8, 2002.
206. "An Overview of ACE+TAO," Boeing, Seattle, November 8th, 2002.
207. "Pattern-Oriented Software Architecture," Amazon, Seattle, WA, November 6th, 2002.
208. "Using Real-time CORBA Effectively: Patterns and Principles," CORBA Controls Workshop, Grenoble, France, October, 9th, 2002.
209. "Adaptive and Reflective Middleware for Distributed Real-time and Embedded Systems," EMSOFT 2002: Second Workshop on Embedded Software, Grenoble, France, October, 7–9th, 2002.
210. "Designing the Future of Embedded Systems at DARPA IXO," Keynote talk at the 6th Annual Workshop on High-Performance Embedded Computing (HPEC), September 25, Boston, MA.
211. "Open Distributed Computing Platforms," NSF/OSTP Workshop on Information Technology Research for Critical Infrastructure Protection, Lansdowne, VA, September 20th, 2002.
212. "Real-time Object-Oriented Middleware," Distributed Common Ground/Surface System Technical Review Group meeting, Mclean VA, September 19th, 2002.
213. "Research Advances in Middleware for Distributed, Real-time, and Embedded Systems," Computer Communications stream of the 17th IFIP World Computer Congress, Montreal, Canada, August 25-30, 2002.
214. "DARPA Thrusts in Embedded Computing," Mercury Computer Systems, Tyngsboro, MA, July 25th, 2002.
215. "Adaptive and Reflective Middleware for Distributed, Real-time, and Embedded Combat Systems," Boeing Space and Missile Systems, Anaheim, CA, July 9, 2002.
216. "Annual Report on Software Design and Productivity Coordinating Group," Interagency Working Group, ITR&D Spring Planning Meeting, NSF, Ballston, VA, May 10, 2002.
217. "Real-time CORBA Standardization: Past, Present, and Future," panelist in the "Standards Movements in Object-oriented Real-time Computing" panel at the ISORC 2002 Conference, Washington, DC, April 30, 2002.
218. "Towards Adaptive and Reflective Middleware for Distributed Real-time Embedded Systems," Moderator of the *Distributed, Real-time, and Embedded Middleware for Network-Centric Combat Systems* panel at the Software Technology Conference (STC) in Salt Lake City, Utah, April 29, 2002.
219. "Applying Architectural Patterns to Address Key Challenges of Distributed Software," Siemens Architecture Interworking Group, Chicago, IL, April 24, 2002.
220. "Towards Adaptive and Reflective Middleware for Distributed Real-time and Embedded Systems," Space and Missile Defense Command, Huntsville, AL, April 22, 2002.
221. "How to Maintain Superiority in the Face of the Commoditization of IT," tutorial at the UCI CEO Roundtable, Maui, Hawaii, April 12, 2002.
222. "Transformation or Transmogrification? Surviving the Commoditization of IT," panelist at the UCI CEO Roundtable, Maui, Hawaii, April 11, 2002.
223. "Patterns and Principles of Mission-critical Middleware," Henry Samueli School of Engineering Research Review, University of California, Irvine, March 14th, 2002.
224. "DARPA: an Agency Overview," CRA Academic Careers Workshop, Arlington, Virginia, February 10 - 12, 2002.
225. "Towards Adaptive and Reflective Middleware for Distributed, Real-time, and Embedded Systems," Electrical Engineering and Computer Science Department, Vanderbilt University, January 28th, 2002.
226. "Protecting Critical Cyber Infrastructure from Asymmetric Threats," panelist at the 7th IEEE Workshop on Object-oriented Real-time Dependable Systems, San Diego, CA, January 10, 2002.

227. "The Researcher's Dilemma: When Technology Success Causes Great Communities to Fail (at Mission-oriented R&D Agencies)," Software Design and Productivity Coordinating Group Workshop on New Visions for Software Design and Productivity: Research and Applications, Nashville, TN, December 13-14, 2001.
228. "Towards Adaptive and Reflective Middleware for Mission-Critical Systems," Computer Science Department, College of William and Mary, September 7th, 2001.
229. "Adaptive and Reflective Middleware Systems," Lockheed Martin, Moorestown, NJ, August 21st, 2001.
230. "Adaptive and Reflective Middleware Systems," United Technology Research Center, Hartford, Connecticut, June 28th, 2001.
231. "Adaptive and Reflective Middleware Systems," Raytheon Annual Processing Systems Technology Network (PSTN) Symposium, Lexington, MA, June 20th, 2001.
232. Invited presenter for the Vendors' Panel at the OMG 2nd Workshop on Real-time and Embedded Distributed Object Computing, June 4-7, 2001.
233. "Towards Pattern Languages and QoS-enabled Middleware for Distributed Real-time and Embedded Systems," DARPA ITO workshop on Embedded Software, Lake Tahoe, NV, October 8-10, 2001.
234. "TAO, CORBA, and the HLA/RTI", Keynote talk at the Fifth IEEE International Workshop on Distributed Simulation and Real Time Applications Cincinnati, Ohio, USA August 13-15, 2001.
235. "Patterns and Principles of Middleware for Distributed Real-time and Embedded Systems," Raytheon, Sudbury, March 29th, 2001.
236. "Adaptive and Reflective Middleware Systems," Distinguished Lecture at Florida Atlantic University, Boca Raton, FL, March 1st, 2001.
237. "Adaptive and Reflective Middleware for Mission-Critical Distributed and Embedded Systems," University of Alabama, Birmingham, AL, January 31st, 2001.
238. "Adaptive and Reflective Middleware for Mission-Critical Distributed and Embedded Systems," Telcordia, Morristown, NJ, November 20th, 2000.
239. "Adaptive and Reflective Middleware for Mission-Critical Distributed and Embedded Systems," George Mason University, Fairfax, VA, November 20th, 2000.
240. "Adaptive and Reflective Middleware for Mission-Critical Distributed and Embedded Systems," Lucent CORBA Forum, Naperville, IL, November 17th, 2000.
241. "Putting an ORB on a Diet," Session on *Performance and QoS of Embedded CORBA ORBs* at the OMG's Workshop on Embedded Object-Based Systems, January 17-19, 2001.
242. "Adaptive and Reflective Middleware Systems," Panelist in a session on "Highly Distributed Systems," at the IEEE Symposium on Applications and the Internet, San Diego, CA, January 10, 2001.
243. "Adaptive and Reflective Middleware Systems," Panelist at the NSF Networking PI meeting, Irvine California, November 1st, 2000.
244. "Surviving the Tornado: The Best Kept Secrets of R&D Success in the Internet Age," Keck Observatory, Hawaii, October 9th, 2000.
245. "Adaptive and Reflective Middleware Systems," BBN Technologies, Boston, MA, September 27th, 2000.
246. "Distributed Application Integration: Myth or Reality?" Keynote talk at 2nd International Symposium on Distributed Objects and Applications (DOA '00), OMG, Antwerp, Belgium, September 21st, 2000.
247. "Surviving the Tornado: The Best Kept Secrets of R&D Success in the Internet Age," Keynote talk at 2nd International Symposium on Distributed Objects and Applications (DOA '00), OMG, Antwerp, Belgium, September 21st, 2000.
248. "High Confidence Adaptive and Reflective Middleware: Fact or Fiction?" Keynote talk for the IFIP Fourth International Conference on Formal Methods for Open Object-Based Distributed Systems, (FMOODS 2000), Stanford University, Stanford, CA, September 7th, 2000.

249. "Adaptive and Reflective Middleware Systems," Lockheed Martin, Ft. Worth, TX, September 6th, 2000.
250. Pattern-oriented Software Architecture: Concurrent and Networked Objects, Raytheon, San Diego, August 25, 2000.
251. "Adaptive and Reflective Middleware Systems," Rockwell/Collins, Cedar Rapids, Iowa, August 22, 2000.
252. "Adaptive and Reflective Middleware Systems," Lockheed Martin, Eagan, MN, August 21, 2000.
253. "Adaptive and Reflective Middleware Systems," Honeywell Technology Center, Minneapolis, MN, August 18, 2000.
254. "Adaptive and Reflective Middleware Systems," Raytheon, Falls Church, VA, July 12, 2000.
255. "Applying Patterns to Develop High-performance and Real-time Object Request Brokers," Lockheed Martin, Eagan, Minnesota, May 19, 2000.
256. "Patterns and Principles of Real-time Object Request Brokers," Cisco, San Jose, April 12, 2000.
257. "Patterns and Principles of Real-time Object Request Brokers," BellSouth, Atlanta, Georgia, March 3, 2000.
258. "Patterns and Principles of Real-time Object Request Brokers," Distinguished Lecturer Series, Michigan State University, East Lansing, Michigan, October 21, 1999.
259. "Towards Minimum ORBs for Wireless Devices and Networks," OPENSIG '99 Workshop, Carnegie Mellon University, Pittsburgh, October, 14-15, 1999.
260. "Applying CORBA Fault Tolerant Mechanisms to Network Management," Lucent CORBA Forum, Naperville, IL, September 28th, 1999.
261. "CORBA for Real-time and Embedded Telecom Systems," Lucent CORBA Forum, Naperville, IL, September 28th, 1999.
262. "Patterns and Principles of Real-time Object Request Brokers," BEA, Munich, Germany, September 16th, 1999.
263. "Real-time CORBA – Fact or Fiction," Siemens CORBA Day, Munich, Germany, September 15th, 1999.
264. "Patterns and Principles of Real-time Object Request Brokers," Siemens MED, Erlangen, Germany, September 13th, 1999.
265. "Patterns and Principles of Real-time Object Request Brokers," RT DII COE TWG, Boeing, Seattle, WA August 25th, 1999.
266. "Patterns for Real-time Middleware," Microsoft, Redmond, WA, August 24th, 1999.
267. "Patterns and Principles of Real-time Object Request Brokers," Lockheed Martin, Eagan, Minnesota, June 22nd, 1999.
268. "Using the ACE Framework and Patterns to Develop OO Communication Software," Dreamworks SGK, Glendale, CA, May 5th, 1999.
269. "Why Telecom Reuse has Failed and how to Make it Work for You," Keynote talk at Nortel Design Forum, Ottawa, CA, April 22nd, 1999.
270. "QoS-enabled Middleware for Monitoring and Controlling High-Speed Networks and Endsystems," Lucent Bell Labs, Murray Hill, NJ, April 15th, 1999.
271. "Optimization Patterns for High-performance, Real-time Object Request Broker Middleware," University of California, Irvine, April, 2nd, 1999.
272. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent, Columbus, OH, March 18-19 and 25-26, 1999.
273. "Using Design Patterns, Frameworks, and Object-Oriented Communication Systems," Lucent, Holmdel, NJ, March 1-4, 1999.
274. Chaired a panel on "Research Directions for Middleware," NSF PI meeting, Washington, DC, January 24th, 1999.
275. "Principles and Patterns of High-performance Real-time CORBA," University of Southern California, Los Angeles, CA, December 10th, 1998.

276. "Real-time CORBA for Telecom – Fact or Fiction?," Bellcore, Morristown, NJ, December 1st, 1998.
277. "Design Patterns for Real-time Object Request Brokers," Silicon Valley Patterns Group, San Francisco, November 15, 1998.
278. "Why Reuse has Failed and how to Make it Work for You," Keynote talk at Lucent Software Symposium, October 27th, Murray Hill, NJ, 1998.
279. "Real-time CORBA – Fact or Fiction," Lucent CORBA Forum, Holmdel, NJ, September 29, 1998.
280. "Applying Software Design Patterns and Framework to Telecommunication Applications," Nortel Advanced Software Computing and Technology, Monday, April 6, 1998, Ottawa, Canada.
281. "Patterns and Performance of Real-time Object Request Brokers," University of California, Santa Barbara, February 20, 1998.
282. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of Frankfurt, Germany, February 12th, 1998.
283. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of Illinois, Urbana-Champaign November 12th, 1997.
284. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of Missouri, Kansas City, October 31st, 1997.
285. "Principles and Patterns of High-performance, Real-time Object Request Brokers," IBM T.J. Watson Research, September 15, 1997.
286. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of California, Santa Barbara, August 21st, 1997.
287. "Principles and Patterns of High-performance, Real-time Object Request Brokers," Lucent Technologies, Naperville, IL August 19th, 1997.
288. "Mastering Software Complexity with Reusable Object-Oriented Frameworks, Components, and Design Patterns," 3rd NSA Software Reuse Symposium, August 20th, 1997.
289. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of Utah, Salt Lake City, Utah, August 11th, 1997.
290. "Using the ACE Framework and Design Patterns to Develop Object-Oriented Communication Software," CERN, Switzerland, July 18th, 1997.
291. "Principles and Patterns of High-performance, Real-time Object Request Brokers," CHOOSE symposium, Zurich, Switzerland, July 17th, 1997.
292. Invited keynote speaker for 2^{nd} Component's User Conference, Munich Germany, July 1997.
293. "Principles and Patterns of High-performance, Real-time Object Request Brokers," Lucent Bell Laboratories, Murray Hill, New Jersey, July 9th, 1997.
294. "Using the ACE Framework and Design Patterns to Develop Object-Oriented Communication Software," Lockheed Martin Tactical Systems, Minneapolis, Minnesota, June 26th, 1997.
295. QoS for Distributed Object Computing Middleware – Fact or Fiction?, panel at the Fifth International Workshop on Quality of Service (IWQoS '97), May 22nd, 1997, Columbia University, NYC, USA.
296. "Design Patterns and Frameworks for Developing Object-oriented WWW Clients and Servers," Carleton University, April 11th, 1997.
297. "Principles and Patterns of High-performance, Real-time Object Request Brokers," University of Maryland, College Park, Maryland, April 2nd, 1997.
298. "A High-Performance End system Architecture for Real Time COBRA," SPARTAN Symposium sponsored by US Sprint, Lawrence Kansas, March 18th, 1997.
299. "Experience with CORBA for Communication Systems," Motorola, Chicago, January 24th, 1997.
300. "High-performance CORBA," Bay Area Object Interest Group, Stanford Linear Accelerator Center, California, December 5th, 1996.
301. "Gigabit CORBA – An Architecture for High-performance Distributed Object Computing," Numerical Aerodynamic Simulation group, NASA, Moffett Field, California, December 3rd, 1996.

302. "Towards High-performance, Real-time CORBA," Distinguished Lecturer at Kansas State University, Manhattan, Kansas, November 7th, 1996.
303. "Gigabit CORBA – An Architecture for High-performance Distributed Object Computing," University of California, Los Angeles, October 3rd, 1996.
304. "Design Patterns and Frameworks for Object-Oriented Communication Software," NSA Software Reuse Symposium, August 28th, 1996.
305. "CORBA – the Good, the Bad, and the Ugly," Lucent Bell-Labs, Naperville, IL, August 22nd, 1996.
306. "Components: the Good, the Bad, and the Ugly," keynote talk for the 1st Components Users Conference, SIEMENS, Munich, Germany, July 15th, 1996.
307. "Design Patterns for Object-Oriented Communication Software," IONA Technologies, Ltd, Dublin, Ireland, July 12th, 1996.
308. "OO Design Patterns and Frameworks for Communication Software," Siemens Corporate Research, Princeton, New Jersey, June 27, 1996.
309. "OO Design Patterns for Concurrent, Parallel, and Distributed Systems," IBM Centre for Advanced Studies, North York, Ontario, Canada, June 17, 1996.
310. "Distributed Object Computing with CORBA", Bell Laboratories, Murray Hill, New Jersey, June 11-12th, 1996.
311. "Design Patterns for Object-Oriented Communication Software," Carleton University, Ottawa, Canada, May 21st, 1996.
312. "Integrating LAN-WAN-Celestial Networks with Design Patterns," Featured technical session at the Object World East conference, Boston, MA, May 9th, 1996.
313. "Using Design Patterns to Develop Object-Oriented Communication Software Frameworks and Applications," McMaster's University, Hamilton, Canada, May 2nd, 1996.
314. "Towards Gigabit CORBA – A High-Performance Architecture for Distributed Object Computing," University of Nevada, Reno, April 25th, 1996.
315. "Domain Analysis: From Tar Pit Extraction to Object Mania?" Panelist at the 4th International Conference on Software Reuse, Orlando, Florida, April 25^{th}, 1996. (other panelists include Spencer Peterson, SEI CMU, Mark Simos, Organon Motives Inc., Will Tracz, Loral, and Nathan Zalman, BNR Inc).
316. "Concurrent Object-Oriented Network Programming with C++," Kodak Imaging Technology Center, April 19^{th}, 1996.
317. "Using OO Design Patterns and Frameworks to Develop Object-Oriented Communication Systems," INRS/NorTel Workshop on Telecommunication Software, Montreal, CA, March 14^{th}, 1996.
318. "Concurrent Object-Oriented Network Programming with ACE and C++," for Siemens Medical Engineering, Erlangen Germany, February 15^{th}, 1996.
319. "OO Componentware" Panelist at the *OOP '96 Conference*, SIGS, Munich, Germany, February 13^{st}, 1996. (other panelists included Michael Stal (Siemens AG) and Frank Buschmann (Siemens AG).
320. "Using Design Patterns to Develop High-performance Object-Oriented Communication Software Frameworks," for the Department of Information Systems, Institute of Computer Science, Johannes Kepler University of Linz, Austria, February 12^{th}, 1996.
321. "The Performance of Object-Oriented Components for High-speed Network Programming," for the Digital Libraries research group at Stanford University, Palo Alto California, February 2^{nd}, 1996.
322. "Distributed Object Computing with CORBA, ACE, and C++," for South Western Bell Telephone advanced distributed systems group, St. Louis, MO., January 26^{th}, 1996.
323. "OO Design Patterns for Large-Scale Object-Oriented Communication Software Systems," AG Communication Systems, Phoenix, Arizona, December $11 - 13^{th}$, 1995.
324. "Experience Using OO Design Patterns to Develop Large-Scale Object-Oriented Communication Software Systems," Bell Northern Research, 7th Annual Design Forum, Ottawa, Canada, December 6^{th}, 1995.

325. "Using OO Design Patterns to Develop Large-Scale Distributed Systems," Object Technology International, Ottawa, Canada, November 22^{nd}, 1995.
326. "Design Patterns for Concurrent, Parallel, and Distributed Systems," North Dallas Society for Object Technology, September 13^{th}, 1995.
327. "Using Design Patterns for Iridium Communication Services," at Motorola Iridium, Chandler, AZ, June 30^{th}, 1995.
328. "Object Technology and the World-Wide Information Infrastructure," Panelist at ECOOP '95, Aarhus, Denmark, August 9^{th}, 1995.
329. "Measuring the Performance of CORBA over ATM Networks," HP Labs, Palo Alto, CA, June 28^{th}, 1995.
330. "Measuring the Performance of Object-Oriented Components for High-speed Network Programming," The C++ and C SIG user group, New York, New York, June 5^{th}, 1995.
331. "An Overview of Design Patterns for Object-Oriented Network Programming," St. Louis Chapter of the ACM, St. Louis, MO, March 13^{th} 1995.
332. "Design Patterns for Concurrent Object-Oriented Network Programming," Distributed Systems group at Siemens Corporate Research Center, Munich, Germany, March 3^{rd}, 1995.
333. "Patterns: 'Eureka,' 'Deja-Vu,' or 'Just Say No'?" Panelist at the *OOP '95 Conference*, SIGS, Munich, Germany January 31^{st}, 1995. (other panelists included Richard Helm, (DMR), Frank Buschmann (Siemens AG), and Dave Thomas (OTI).
334. "Developing Distributed Applications with the ADAPTIVE Communication Environment," *The* 12^{th} *Annual Sun Users Group Conference*, SUG, San Francisco, California, June 17^{th}, 1994.
335. "Flexible Configuration of High-performance Distributed Communication Systems," presented at the ETH-Zentrum in the Swiss Federal Institute of Technology, Zurich, Switzerland, May 31^{st}, 1994.
336. "Object Oriented Techniques for Developing Distributed Applications," *Computer Science Department Colloquia*, California State University Northridge, December 7^{th}, 1993.
337. "Hosting the ADAPTIVE System in the *x*-Kernel and System V STREAMS," *The x-Kernel Workshop*, IEEE, Tucson, Arizona, November 10^{th}, 1992.
338. "An Environment for Controlled Experimentation on the Performance Effects of Alternative Transport System Designs and Implementations," IBM T. J. Watson Research Center, Hawthorne, New York, September 10^{th}, 1992.

Colloquia, Seminars, and Tutorials

1. "Programming with Java Lambdas and Streams," O'Reilly Live Training, December 6th, 2021.
2. "Design Patterns in Java," O'Reilly Live Training, November 15th and 16nd, 2021.
3. "Scalable Reactive Programming with Java," O'Reilly Live Training, September 9th, 2021.
4. "Design Patterns in Java," O'Reilly Live Training, September 1st and 2nd, 2021.
5. "Programming with Java Lambdas and Streams," O'Reilly Live Training, July 20th, 2021.
6. "Scalable Reactive Programming with Java," O'Reilly Live Training, May 17th, 2021.
7. "Scalable Reactive Programming with Java," O'Reilly Live Training, January 22nd, 2021.
8. "Programming with Java Lambdas and Streams," O'Reilly Live Training, January 13th, 2021.
9. "Design Patterns in Java," O'Reilly Live Training, November 12th and 13th, 2020.
10. "Design Patterns in Java," O'Reilly Live Training, September 17th and 18th, 2020.
11. "Programming with Java Lambdas and Streams," O'Reilly Live Training, September 14th, 2020.
12. "Core Java Synchronizers," O'Reilly Live Training, August 20th, 2020.
13. "Scalable Reactive Programming with Java," O'Reilly Live Training, August 19th, 2020.
14. "Programming with Java Lambdas and Streams," O'Reilly Live Training, June 1st, 2020.
15. "Design Patterns in Java," O'Reilly Live Training, May 27th and 28th, 2020.

16. "Core Java Synchronizers," O'Reilly Live Training, May 18th, 2020.
17. "Programming with Java Lambdas and Streams," O'Reilly Live Training, March 30th, 2020.
18. "Design Patterns in Java," O'Reilly Live Training, March 23rd and 24th, 2020.
19. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, February 24th, 2020.
20. "Core Java Synchronizers," O'Reilly Live Training, February 10th, 2020.
21. "Design Patterns in Java," O'Reilly Live Training, January 29th and 30th, 2020.
22. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, January 22nd, 2020.
23. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, January 22nd, 2020.
24. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, November 27th, 2019.
25. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, November 18th, 2019.
26. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, November 6th, 2019.
27. "Design Patterns in Java," O'Reilly Live Training, November 4th and 5th, 2019.
28. "Design Patterns in Java," O'Reilly Live Training, September 17th and 18th, 2019.
29. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, September 3rd, 2019.
30. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, August 29th, 2019.
31. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, August 15th, 2019.
32. "Design Patterns in Java," O'Reilly Live Training, July 29th and 30th, 2019.
33. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, August 15th, 2019.
34. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, July 2nd, 2019.
35. "Design Patterns in Java," O'Reilly Live Training, June 13th and 14th, 2019.
36. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, May 16th, 2019.
37. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, May 13th, 2019.
38. "Design Patterns in Java," O'Reilly Live Training, April 17th and 18th, 2019.
39. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, March 27th, 2019.
40. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, March 12th, 2019.
41. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, March 5th, 2019.
42. "Design Patterns in Java," O'Reilly Live Training, February 26th and 27th, 2019.
43. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, February 19th, 2019.
44. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, February 5th, 2019.
45. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, January 22nd, 2019.
46. "Design Patterns in Java," O'Reilly Live Training, January 7th and 8th, 2019.
47. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, December 11th, 2018.
48. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, December 6th, 2018.
49. "Design Patterns in Java," O'Reilly Live Training, November 13th and 14th, 2018.
50. "Scalable Concurrency with the Java Executor Framework," O'Reilly Live Training, October 29th, 2018.

51. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, October 16th, 2018.
52. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, October 4th, 2018.
53. "Design Patterns in Java," O'Reilly Live Training, September 18th and 19th, 2018.
54. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, September 4th, 2018.
55. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, August 30th, 2018.
56. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, August 20th, 2018.
57. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, July 25th, 2018.
58. "Design Patterns in Java," O'Reilly Live Training, July 2nd and 3rd, 2018.
59. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, June 26th, 2018.
60. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, June 25th, 2018.
61. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, June 8th, 2018.
62. "Design Patterns in Java," O'Reilly Live Training, May 24th and 25th, 2018.
63. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, April 26th, 2018.
64. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, April 17th, 2018.
65. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, April 13th, 2018.
66. "Design Patterns in Java," O'Reilly Live Training, April 3rd, 2018.
67. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, March 13th, 2018.
68. "Scalable Programming with Java 8 Parallel Streams: Part 2," O'Reilly Live Training, March 7th, 2018.
69. "Scalable Programming with Java 8 Parallel Streams: Part 1," O'Reilly Live Training, March 6th, 2018.
70. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, March 1st, 2018.
71. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, February 13th, 2018.
72. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, February 6th, 2018.
73. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, February 1st, 2018.
74. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, January 12th, 2018.
75. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, January 10th, 2018.
76. "Reactive Programming with Java 8 CompletableFutures," O'Reilly Live Training, January 9th, 2018.
77. "Reactive Programming with Java 8 Completable Futures," O'Reilly Live Training, October 23rd, 2017.
78. "Programming with Java 8 Lambdas and Streams," O'Reilly Live Training, October 19th, 2017.
79. "Scalable Programming with Java 8 Parallel Streams," O'Reilly Live Training, October 17th, 2017.
80. "Java 8 Concurrency," O'Reilly Live Training, September 7-8th, 2017.
81. "Java 8 Concurrency," O'Reilly Live Training, August 30-31st, 2017.
82. "Java 8 Concurrency," O'Reilly Live Training, June 28-29th, 2017.
83. "The C++ Standard Template Library," Qualcomm, San Diego, February 16-19, 2016.
84. "The C++ Standard Template Library," Qualcomm, San Diego, October 13-16, 2015.
85. "The C++ Standard Template Library," Qualcomm, San Diego, October 13-16, 2015.
86. "Pattern-Oriented Java Concurrency," InformIT Webinar, May 14th, 2015.

87. "Pattern-Oriented Concurrent Programming with Java," OOP Conference, Munich, Germany, January 30th, 2015.
88. "Concurrent Programming in Android," OOP Conference, Munich, Germany, January 29th, 2015.
89. "The C++ Standard Template Library," Qualcomm, San Diego, October 14-17, 2014.
90. "The C++ Standard Template Library," Qualcomm, San Diego, August 5-8, 2014.
91. "Pattern-Oriented Software Architecture for Concurrent and Networked Software," July 28-31, 2014.
92. "The C++ Standard Template Library," Qualcomm, San Diego, August 5-8, 2014.
93. "The C++ Standard Template Library," Qualcomm, India, March, 2014.
94. "The C++ Standard Template Library," Qualcomm, San Diego, CA, January 23-34, 2014.
95. "The C++ Standard Template Library," Qualcomm, San Diego, CA, October 16-17th, 2013.
96. "Patterns and Frameworks for Concurrent and Networked Software," 2013 International Summer School on Trends in Computing Tarragona, Spain, July 25-26, 2013.
97. "The C++ Standard Template Library," Qualcomm, San Diego, CA, January 23-24th, 2013.
98. "The C++ Standard Template Library," Qualcomm, San Diego, CA, October 4-5th, 2012.
99. "Embedded Systems Patterns for C Developers," Qualcomm, San Diego, CA, August 28th, September 11th, September 25th, October 9th, October 23rd, and November 6th, 2012.
100. "Embedded Systems Patterns for C Developers," Qualcomm, San Diego, CA, August 14-15th, 2012.
101. "The C++ Standard Template Library," Qualcomm, San Diego, CA, May 15-18th, 2012.
102. "The C++ Standard Template Library," Qualcomm, San Diego, CA, January 25-26th, 2012.
103. "Object-Oriented Software Patterns and Frameworks," Qualcomm, San Diego, CA, October 11-12th, 2011.
104. "The C++ Standard Template Library," Qualcomm, San Diego, CA, May 11-12th, 2011.
105. "The C++ Standard Template Library," Qualcomm, San Diego, CA, January 25-26, 2011.
106. "Pattern-Oriented Software Architecture: A Pattern Language for Concurrent and Networked Software," SPLASH 2010, October 17-21, 2010, Reno, Nevada.
107. "Pattern-Oriented Software Architectures - Patterns and Frameworks for Concurrent and Networked Software," ProObject, Hanover, MD, August 11th, 2010.
108. "Pattern-Oriented Software Architecture: Patterns for Concurrent and Networked Embedded Systems," Qualcomm, Bangalore, India, June 21-22, 2010.
109. "Pattern-Oriented Software Architecture: Patterns for Concurrent and Networked Embedded Systems," Qualcomm, Hyderabad, India, June 24-25, 2010.
110. "Pattern-Oriented Software Architecture: A Pattern Language for High Quality and Affordable Distributed Computing Systems," IEEE Webinar Series, June 10th, 2010.
111. "The C++ Standard Template Library," Qualcomm, San Diego, CA, May 12-13, 2010.
112. "The C++ Standard Template Library," Qualcomm, San Diego, CA, December 16-17, 2009.
113. "Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing," OOPSLA 2009, Orlando, FL, October, 2009.
114. "The C++ Standard Template Library," Qualcomm, San Diego, CA, September 15-16, 2009.
115. "Networked Embedded Systems Patterns for C Developers," Qualcomm, San Diego, CA, June 11-12, 2009.
116. "Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing," Software Architecture Technology Users' Network (SATURN) workshop May 5, 2009 in Pittsburgh, PA.
117. "The C++ Standard Template Library," Qualcomm, San Diego, CA, January 29-30, 2009.
118. "Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing," IEEE Webinar Series, January 8th, 2009.

119. "Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing," OOPSLA 2008, Nashville, TN, October 20, 2008.
120. "The Data Distribution Service for Real-time Systems," OOPSLA 2008, Nashville, TN, October 19, 2008.
121. "Object-Oriented Patterns for Concurrent and Networked Applications," Qualcomm, San Diego, CA, August 5-6th, 2008.
122. "The C++ Standard Template Library," Qualcomm, San Diego, NJ, July 29-30, 2008.
123. "Object-Oriented Patterns and Frameworks with C++," Qualcomm, San Diego, CA, June 12-13, 2008.
124. "The C++ Standard Template Library," Qualcomm, New Jersey, May 5-6, 2008.
125. "Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing," Software Architecture Technology Users' Network (SATURN) workshop April 28 - May 1, 2008 in Pittsburgh, PA.
126. Developing Distributed Computing Systems with Patterns and Middleware, UCLA Extension, February 19-21, 2008.
127. Pattern-Oriented Software Architecture: A Pattern Language for Distributed Computing, OOPSLA 2007, Montreal, CA, October 24, 2007.
128. Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware, Qualcomm, New Jersey, September 27-28, 2007.
129. Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware, Qualcomm, San Diego, CA, August 21-22, 2007.
130. Lightweight CORBA Component Model, 8th OMG Real-time/Embedded CORBA workshop, Washington DC, July 9–12, 2007.
131. Model-Driven Engineering for Distributed Real-time and Embedded Systems, 13th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2007), Bellevue, WA, United States April 3-6, 2007.
132. "Improving Product Reliability and ROI Through Effective Software Reuse," Qualcomm, San Diego, CA, March 27th, 2007.
133. "Developing Distributed Computing Systems with Patterns and Middleware," UCLA Extension, February 21-23, 2007.
134. "POSA: Patterns for Concurrent and Distributed Systems," OOP, Munich, Germany, January 22, 2007.
135. "Meeting the Challenges of Software-Intensive Embedded Systems," OOP, Munich, Germany, January 23, 2007.
136. "Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware," Qualcomm, San Diego, CA, January 10-11, 2007.
137. "Model-Driven Development of Distributed Systems," OOPSLA 2006, Portland, OR, October 22-26, 2006.
138. "Pattern-Oriented Software Architecture: Patterns for Concurrent and Networked Objects," OOPSLA 2006, Portland, OR, October 22-26, 2006.
139. "Model-Driven Engineering of Distributed Systems," MODELS 2006, Genova, Italy, October 1, 2006.
140. "Distributed Real-time and Embedded Systems," Advanced Institute of Information Technology, Seoul, Korea, August 7-11 2006.
141. "Lightweight CORBA Component Model," 7th OMG Real-time/Embedded CORBA workshop, Washington DC, July 10–13, 2006.
142. "How to Use ACE Effectively," Trion World Network, Austin, TX, June 19-21, 2006.
143. "Improving Product Reliability and ROI Through Effective Software Reuse," Qualcomm, San Diego, CA, June 15, 2006.

144. "Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware," Qualcomm, San Diego, CA, June 13-14, 2006.
145. "Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware," Qualcomm, San Diego, CA, Feb 9-10, 2006.
146. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, University of California, Los Angeles Extension, January 18-20st, 2006."
147. "Model Driven Development of Distributed Real-time and Embedded Systems," at the OOP conference, January 17, 2006, Munich, Germany.
148. "Pattern-Oriented Software Architecture," at the OOP conference, January 16, 2006, Munich, Germany.
149. "Model Driven Development: State of the Art," at the OOP conference, January 16, 2006, Munich, Germany.
150. "Concurrent C++ Network Programming with Patterns and Frameworks," C++ Connections: 20 Years of C++ conference, November 11, 2005, Mandalay Bay, Las Vegas, NV.
151. "Pattern-Oriented Software Architecture: Patterns for Concurrent and Distributed Systems," OOPSLA 2005, San Diego, October 17th, 2005.
152. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," BAE Systems, Greenlawn, New York, August 25, September 2-3.
153. "Lightweight CORBA Component Model," 6th OMG Real-time/Embedded CORBA workshop, Washington DC, July 11–14, 2005.
154. "Model Driven Development for Distributed Real-time and Embedded Systems," OMG Information Days: MDA - Frankfurt, Germany, June 9th, 2005
155. "Model Driven Development for Distributed Real-time and Embedded Systems," OMG Information Days: MDA - Munich, Germany, June 7th, 2005.
156. "Model Driven Development for Distributed Real-time and Embedded Systems," OMG Information Days: MDA - Zurich, Switzerland, June 1st, 2005.
157. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," BAE Systems, Wayne, New Jersey, May 13, 16, 19, 23, 27, 2005.
158. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," BAE Systems, Wayne, New Jersey, February 18th, February 22nd, March 1, 8, and 15 2005.
159. "Pattern-Oriented Software Architectures for Distributed Systems" the OOP conference, January 28, 2005, Munich, Germany.
160. "Research on Model Driven Development of Distributed Real-time and Embedded Systems," the OOP conference, January 26, 2005, Munich, Germany.
161. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, January 19-21st, 2005.
162. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, BAE Systems, Wayne, New Jersey, October 29, November 1, 8, 15, 22, 2004.
163. "Pattern-Oriented Software Architectures for Distributed Systems," OOPSLA 2004, Vancouver, British Columbia, October 25th, 2004.
164. "Notes on the Forgotten Craft of Software Architecture", OOPSLA 2004, Vancouver, British Columbia, October 25th, 2004.
165. "Model Driven Architecture with QoS-enabled component middleware," MDE for Embedded Systems, Brest, France, September 10th 2004.
166. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Qualcomm, San Diego, CA, Jan 7-6, 2005.
167. "Object-Oriented Design and Programming with Patterns, Frameworks, and Middleware," Qualcomm, San Diego, CA, Jan 9-10, 2005.

168. "Using the Lightweight CORBA Component Model to Develop Distributed Real-time and Embedded Applications," OMG Workshop on Distributed Object Computing for Real-time and Embedded Systems, July 12th, 2004, Reston, VA.
169. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, July 7-9th, 2004.
170. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, University of California, Los Angeles Extension, January 21st-23rd, 2004.
171. Patterns and Frameworks for Concurrent Distributed Systems, SIGS OOP Conference, Munich, Germany, January 19th, 2004.
172. Middleware for Distributed Real-time and Embedded Systems, SIGS OOP Conference, Munich, Germany, January 19th, 2004.
173. "Pattern-Oriented Software Architectures for Networked and Concurrent Applications," OOPSLA 2003, Anaheim, CA, October 27, 2003.
174. The JAOO 2003 conference, September 22-26, Aarhus, Denmark.
175. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, July 9-11th, 2003.
176. "Patterns, Frameworks, and Middleware: Their Synergistic Relationship," Frontiers of Software Practice, International Conference on Software Engineering, Portland, Oregon, May 7, 2003.
177. "Pattern-Oriented Distributed Systems Architecture," International Conference on Software Engineering, Portland, Oregon, May 5, 2003.
178. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, January 22nd-24th, 2003.
179. "Patterns and Application Experiences for Real-time Object Request Brokers," OOPSLA 2002, Seattle, Washington, November, 2002.
180. "Pattern-Oriented Software Architectures for Networked and Concurrent Applications," OOPSLA 2002, Seattle, Washington, November, 2002.
181. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, Raytheon, St. Petersburg, FL, September 3–5, 2003.
182. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, University of California, Los Angeles Extension, July 22nd-24th, 2002.
183. "Policies and Patterns for High-performance, Real-time Object Request Brokers," Mercury Computer Systems, Tysons Corner, VA, November Feb 7, 2002.
184. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, University of California, Los Angeles Extension, January 23rd-25th, 2002.
185. "Policies and Patterns for High-performance, Real-time Object Request Brokers," Raytheon, Rosslyn, VA, November 12th, 2001.
186. "Pattern-Oriented Software Architecture: Patterns for Concurrent and Networked Objects," OOPSLA 2001, October 15th, 2000, Minneapolis, Minnesota.
187. "Policies and Patterns for High-performance, Real-time Object Request Brokers," International Symposium on Distributed Object Applications (DOA), Rome, September 17-20, 2001.
188. "Policies and Patterns for QoS-enabled Middleware," The JAOO 2001 conference, September 10-14, Aarhus, Denmark.
189. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, July 23rd-25th, 2001.
190. "Policies and Patterns for High-performance, Real-time Object Request Brokers," OMG Second Workshop on Real-time and Embedded Distributed Object Computing on June 4-7, 2001 in Herndon, VA, USA.
191. "Design Patterns for Understanding Middleware and Component Infrastructures," 6th USENIX Conference on Object-Oriented Technologies and Systems, January 29, 2001, San Antonio, TX.

192. "Principles and Patterns of High-performance, Real-time Object Request Brokers," OOP conference, Munich, Germany, January 23, 2001.
193. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, January 3-5, 2001.
194. "Patterns for Concurrent and Distributed Objects," OOPSLA 2000, October 16th, 2000, Minneapolis, Minnesota.
195. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Berkeley Extension, May 24-26, 2000.
196. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Jet Propulsion Laboratory, Pasadena, CA, April, 2000.
197. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Los Angeles Extension, March 27-31, 2000.
198. "Optimizing Middleware to Support High-Performance Real-time Distributed and Embedded Systems," OOP conference, Munich, Germany, January 27, 2000.
199. "Effective Architectures for DOC," OOP conference, Munich, Germany, January 24, 2000.
200. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California, Berkeley Extension, December 13-15, 1999.
201. "Middleware Techniques and Optimizations for Real-time Embedded Systems," 12th International Symposium On System Synthesis, IEEE, San Jose, CA, USA November, 11, 1999
202. "Patterns and Principles of Real-time Object Request Brokers," OOPSLA 1999, ACM, Denver, Colorado, November 1-5, 1999.
203. "Using Design Patterns, Frameworks and CORBA to Reduce the Complexity of Developing Reusable Large-Scale Object-Oriented Concurrent Communication Components and Systems," Fifth IEEE International Conference on Engineering of Complex Computer Systems, Las Vegas, Nevada, October 18-21, 1999
204. "Distributed Technologies," Motorola, Schaumburg, IL, August 10-12, 1999.
205. "Patterns and Principles of Real-time Object Request Brokers," the 3rd Components Users Conference, SIEMENS, Munich, Germany, July 12th, 1999.
206. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent, Naperville, IL, June 23-24 and June 30 - July 1st, 1999.
207. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Motorola Software Symposium, Ft. Lauderdale, Florida, June 21st, 1999.
208. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California Los Angeles Extension, June 2-4, 1999.
209. "Concurrent Object-Oriented Network Programming and Distributed Object Computing," University of California Berkeley Extension, May 19-21, 1999.
210. "Patterns and Principles of Real-time Object Request Brokers," 5th USENIX Conference on Object-Oriented Technologies and Systems, May 4, 1999, San Diego, CA.
211. "Real-time CORBA for Telecom – Fact or Fiction?" Nortel Design Forum, Ottawa, CA, April 22, 1999.
212. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent, Columbus, OH, March 18-19 and 25-26, 1999.
213. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent, Holmdel, NJ, March 1-4, 1999.
214. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent/Octel, Milpitas, CA, December 14-16, 1998.
215. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California Los Angeles Extension, December 8-10, 1998.
216. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Motorola, Schaumburg, IL, December 2-4, 1998.

217. "Concurrent Object-Oriented Network Programming and Distributed Object Computing," University of California Berkeley Extension, November 16-18, 1998.
218. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Software," OOPSLA 1998, October 19th, 1998, Vancouver, British Columbia.
219. "High-Performance CORBA," Lucent CORBA Forum, Holmdel, NJ, September 29, 1998.
220. "Writing Efficient Multi-Thread CORBA Applications," the 3rd Components Users Conference, SIEMENS, Munich, Germany, July 10, 1998.
221. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Software," UCLA extension course, Milan, Italy, June 29 - July 1, 1998.
222. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," Lucent, Naperville, IL, June 8-11, 1998.
223. "Patterns and Performance of Real-time Object Request Brokers," Fourth IEEE Real-Time Technology and Applications Symposium (RTAS), Denver, Colorado, June 5, 1998.
224. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California Los Angeles Extension, June 1-3, 1998.
225. "Patterns and Principles of Real-time Object Request Brokers," NSA, Ft. Meade, MD, March 22, 1998.
226. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, Crosskeys, Ottawa Canada, March 19-21, 1998.
227. "Concurrent Object-Oriented Network Programming and Distributed Object Computing," University of California Berkeley Extension, March 4-6, 1998.
228. "Building Distributed Communication Software with CORBA," the Motorola Systems Symposium, February, 1998, Austin, Texas, USA.
229. "Introduction to Distributed Objects with CORBA," SIGS OOP '98, February 9-13, 1998, Munich, Germany.
230. "Design Patterns for Developing and Using CORBA Object Request Brokers," SIGS OOP '98, February 9-13, 1998, Munich, Germany.
231. Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems, Lucent Technologies, Whippany, NJ, January 5-6, 1998.
232. "Using Design Patterns, Frameworks, and CORBA to Develop Object-Oriented Communication Systems," University of California Los Angeles Extension, December 10-12, 1997.
233. "Concurrent Object-Oriented Network Programming and Distributed Object Computing," University of California Berkeley Extension, December 10-12, 1997.
234. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Systems," Motorola Cellular Infrastructure Group, Arlington Heights, Illinois, December 1 - 3, 1997.
235. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Systems," TOOLS Pacific '97, Melbourne, Australia November 24 - 27, 1997.
236. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Systems" for the IEEE GLOBECOM '97 conference, Phoenix, AZ, November 4-8, 1997.
237. "High-performance Distributed Object Computing with CORBA," IEEE International Conference on Network Protocols, Atlanta, GA, October 28th, 1997.
238. "Using Design Patterns and Frameworks to Develop Object-Oriented Communication Systems," OOPSLA 1997, ACM, Atlanta, GA, October 6-7th, 1997.
239. "Using Design Patterns and Frameworks to Develop Object-oriented Communication Systems," 24th International Conference on Technology of Object-Oriented Languages and Systems (TOOLS Asia '97). Beijing, China, September 22, 1997.
240. "Principles and Patterns of Distributed Object Computing Systems," for the ACM Principles of Distributed Computing Conference (PODC), Santa Barbara, CA, August 21st, 1997.
241. "Distributed Object Computing with CORBA and ACE," Alta Software, Jacksonville, FL, June 4-5th, 1997.

242. "Distributed Object Computing with CORBA", Object Expo, NY, NY, June 2nd, 1997.
243. "Concurrent Object-Oriented Network Programming and Distributed Object Computing," University of California Berkeley Extension, May 28-30, 1997.
244. "Patterns and Principles of Real-time Object Request Brokers," National Security Agency, Ft. Meade, MD, May 13th, 1997.
245. "Building Distributed Communication Software with CORBA," the Motorola Systems Symposium, March, 1997, Chandler, AZ, USA.
246. "Evaluating Concurrency Models for CORBA Servers," the 2nd Components Users Conference, SIEMENS, Munich, Germany, July 14th, 1997.
247. "Design Patterns for Evolving System Software Components from UNIX to Windows NT," the 2st Components Users Conference, SIEMENS, Munich, Germany, July 14th, 1997.
248. "Techniques and Patterns for Distributed Object Computing with CORBA and C++," University of California Berkeley Extension, December 4-6, 1996.
249. "Design Patterns for Concurrent Object-Oriented Programming with ACE and C++," C++ World, Dallas, TX, November 11th, 1996.
250. "Implementing Concurrent CORBA Applications with Multi-Threaded Orbix and ACE," C++ World, Dallas, TX, November 12th, 1996.
251. "Why Reuse has Failed, and How You Can Make it Work for You," Berne Technology Forum 1996, Berne, Switzerland, October 18, 1996.
252. "Introduction to Distributed Object Programming with CORBA," the Local Computer Networks '96 conference, IEEE, Minneapolis, Minnesota, October 13, 1996.
253. "Object-Oriented Design Patterns for Concurrent, Parallel, and Distributed Systems," the OOPSLA 1996 conference, ACM, San Jose, California, October, 1996.
254. "OO Design Patterns Network Programming in C++," Object Expo Europe, London, England, September 23rd, 1996.
255. "Effective Multithreaded CORBA Programming," Object Expo Europe, London, England, September 24th, 1996.
256. "Workshop on Object Oriented Technologies," Mitsubishi, July 22nd to July 26th, 1996, Kobe, Japan.
257. "Evaluating Concurrency Models for CORBA Servers," the 1st Components Users Conference, SIEMENS, Munich, Germany, July 15th, 1996.
258. "Design Patterns for Evolving System Software Components from UNIX to Windows NT," the 1st Components Users Conference, SIEMENS, Munich, Germany, July 15th, 1996.
259. "OO Design Patterns for Concurrent, Parallel, and Distributed Systems," the 2^{nd} *Conference on Object-Oriented Technology*, USENIX, Toronto, Canada, June 17, 1996.
260. "OO Design Patterns for Concurrent, Parallel, and Distributed Systems," the 3^{rd} *Conference on Object-Oriented Technology*, USENIX, Portland, Oregon, June 16th, 1996.
261. "OO Design Patterns for Network Programming in C++," the *Object Expo '96 Conference*, SIGS, Sydney, Australia, June 3^{rd}, 1996.
262. "Effective Multi-threaded CORBA Programming Programming," the *Object Expo '96 Conference*, SIGS, Sydney, Australia, June 5^{th}, 1996.
263. "Concurrent Object-oriented Network Programming with C++," University Of California Berkeley Extension, Berkeley, California, May $22^{nd} - -24^{th}$, 1996.
264. "Experience Developing Reusable Software Using Object-Oriented Design Patterns and Frameworks," the 4^{th} *International Conference on Software Reuse*, Orlando, Florida, USA April 23-26, 1996.
265. "Techniques for Object-Oriented Network Programming," the *OOP Conference*, SIGS, Munich, Germany, Feb 14th, 1996.
266. "Using Object-Oriented Design Patterns to Develop Large-Scale Distributed Systems," the *OOP Conference*, SIGS, Munich, Germany, Feb 13^{th}, 1996.

267. "Concurrent Object-oriented Network Programming with C++," University Of California Berkeley Extension, Berkeley, California, November 30th-December 1st, 1995.
268. "Using Object-Oriented Design Patterns to Develop Large-Scale Distributed Systems," the 4^{th} *C++ World Conference*, SIGS, Chicago, Illinois, October 31st, 1995.
269. "Techniques for Object-Oriented Network Programming," the 4^{th} *C++ World Conference*, SIGS, Chicago, Illinois, October 31st, 1995.
270. "Experience using OO Design Patterns to Develop Large-scale Distributed Communication Systems," *OOPSLA 1995 Conference* in Austin, Texas, October 1995.
271. "Concurrent Object-oriented Network Programming with C++," the 9^{th} *European Conference on Object-Oriented Programming (ECOOP)*, Aarhus, Denmark, August, 1995.
272. "Concurrent Object-Oriented Network Programming with C++," the 1^{st} *Conference on Object-Oriented Technology*, USENIX, Monterey, California, June 23, 1995.
273. "Design Patterns for Concurrent and Distributed Systems," the *Object Expo '95 Conference*, SIGS, New York, NY, June 5^{th} 1995.
274. "Object Oriented Network Programming," the *Object Expo '95 Conference*, SIGS, New York, NY, June 5^{th}, 1995.
275. "Software Construction with Active Objects in C++," the *OOP '95 Conference*, SIGS, Munich, Germany January 31, 1995.
276. "Object-Oriented Concurrent Programming with C++," the *OOP '95 Conference*, SIGS, Munich, Germany January 31, 1995.
277. "Concurrent Object-Oriented Programming," the *Winter USENIX Conference*, USENIX, New Orleans, Louisiana, January, 1995.
278. "Object-Oriented Network Programming with C++," the 3^{rd} *C++ World Conference*, SIGS, Austin, Texas, November 14, 1994.
279. "Object-Oriented Techniques for Dynamically Configuring Concurrent Distributed Applications," the 9^{th} *OOPSLA 1994*, ACM, Portland, Oregon, October 23, 1994.
280. "Object-Oriented Network Programming," the 6^{th} *C++ Conference*, USENIX, Cambridge, Massachusetts, April 11, 1994.
281. "Object-Oriented Techniques for Developing Extensible Network Servers," the 2^{nd} *C++ World Conference*, SIGS, Dallas, Texas, October 19, 1993.

Professional Activities

Editorial Activities

1. Guest co-editor for a special issue of the Springer Journal Annals of Telecommunications on "Middleware for Internet distribution in the context of Cloud Computing and the Internet of Things," 2016, with Gordon Blair and Chantal Taconet.
2. Guest co-editor of the Proceedings of the IEEE special issue on Applications of Augmented Reality Environments, 2014.
3. Guest co-editor of the International Journal of Network Protocols and Algorithms (NPA) Special Issue on Data Dissemination for Large scale Complex Critical Infrastructures, 2010.
4. Wrote the foreword to the book *Patterns of Parallel Software Design* by Jorge Luis Ortega Arjona, Wiley, 2010.
5. Editorial board member of the Springer Journal of Internet Services and Applications (JISA).
6. Editorial board member of the Transactions on Pattern Languages of Programming (TPLoP) published by Springer-Verlag.
7. Wrote the foreword to the book *Practical Software Factories in .NET*, by Gunther Lenz and Christoph Wienands, Apress, 2006.
8. Guest editor of the IEEE Computer Special Issue on Model Driven Development, February 2006.

9. Guest co-editor of IEEE Network special issue on "Middleware Technologies for Future Communication Networks," February 2004 (co-editors with Gordon Blair and Andrew Campbell).
10. Editorial board member of the Springer Journal of Aspect-Oriented Software Development.
11. Wrote the foreword to the book *Fundamentals of Distributed Object Systems: The CORBA Perspective*, by Zahir Tari and Omran Bukhres, Wiley and Sons, 2001.
12. Wrote the foreword to the book *Design Patterns in Communication Software*, edited by Linda Rising, Cambridge University Press, 2000.
13. Guest editor of the Special Issue on Components and Patterns for *The Journal of Theory and Practice of Object Systems*, Wiley & Sons, to appear 2002.
14. Invited editorial on "Trends in Distributed Object Computing" for the special issue on Distributed Object-Oriented Systems appearing in the Parallel and Distributed Computing Practices journal, edited by Maria Cobb and Kevine Shaw, Vol. 3, No. 1, March 2000.
15. Co-editor of "Building Application Frameworks: Object-Oriented Foundations of Framework Design," John Wiley & Sons, 1999 (co-editors are Mohamed Fayad and Ralph Johnson), ISBN 0-471-24875-4.
16. Co-editor of "Implementing Application Frameworks: Object-Oriented Frameworks at Work," John Wiley & Sons, 1999 (co-editors are Mohamed Fayad and Ralph Johnson), ISBN 0-471-25201-8.
17. Guest editor of the Special Issue on OO Application Frameworks for the Communications of the ACM, (co-editor Mohamed Fayad), ACM, October, 1997.
18. Guest editor of the special issue on Distributed Object Computing for USENIX Computing Systems Journal, November/December, 1996.
19. Guest editor of a feature topic on Distributed Object Computing for IEEE Communications Magazine, February, 1997.
20. Wrote the foreward for Dr. Nayeem Islam's book on *Distributed Objects: Methodologies for Customizing Operating Systems* (IEEE Computer Society Press, 1996).
21. Guest editor of the Special Issue on Patterns and Pattern Languages for Communications of the ACM, (co-editors Ralph Johnson and Mohamed Fayad), ACM, October, 1996.
22. Co-editor of a book entitled "Pattern Languages of Program Design," Addison-Wesley, 1995 (co-editor is Jim Coplien, Bell Labs).
23. Editor of the Patterns++ section of the C++ Report Magazine, April 1997 - March 1998.
24. Editor-in-chief of the C++ Report Magazine, January 1996 - February 1997.
25. Editorial board member of the IEEE Computer Society - Computer Science & Engineering Practice Board.

Program Chairmenships and Conference Organization

1. Chair of the DoD Organic Software Infrastructure Workshop, Arlington VA, August 13th, 2018.
2. General Chair of the Software Product Line Conference, Nashville TN, July/August, 2015.
3. Program Chair of the Interoperable Open Architecture 2013 conference, September 10-11, 2013, Washington, DC.
4. Program Chair of the NSF Workshop on Computing Clouds for Cyber-Physical Systems, March 15th, 2013, Ballston, VA.
5. Program Chair of the Interoperable Open Architecture 2012 conference, October 29-31, 2012, London, UK.
6. Program co-chair for the 1st International Symposium on Secure Virtual Infrastructures (DOA-SVI'11), 17-19 Oct 2011, Crete, Greece.
7. Program co-chair for the COMmunication System softWAre and middleware (Comsware) conference, Helsinki, Finland, August 2010.
8. Doctoral symposium chair for OOPSLA 2009, Orlando Floria, October 25-29, 2009.
9. General co-chair for the 3rd ACM International Conference on Distributed Event-Based Systems (DEBS 2009), July 6-9, 2009 - Nashville, TN, USA.

10. Member of the ISORC 2009 advisory and publicity committee for ISORC 2009, March 17-20, 2009, Toyko, Japan.
11. Area Coordinator for the Integrating Systems of Systems using Services topic at the 6th International Conference on Service Oriented Computing, Sydney (Australia), December 1st - 5th, 2008.
12. Member of the Advisory and Publicity Committee for ISORC 2008, Orlando, Florida, May 5 -7, 2008.
13. Co-chair of the Middleware for Network Eccentric and Mobile Applications (MiNEMA.08) Workshop co-located with ACM EuroSys Conference, March 31 - April 1, 2008, Glasgow, Scotland.
14. General chair of the ACM/IEEE 10th International Conference on Model Driven Engineering Languages and Systems (MODELS 2007), Nashville TN, September 30-October 5, 2007.
15. Area co-coordinator for the Quality of Service research track at the The Fifth International Conference on Service-Oriented Computing, September 17-20, 2007, Vienna, Austria.
16. Program co-chair of the NSF workshop on New Research Directions in Composition and Systems Technology for High Confidence Cyber Physical Systems, July 9, 2007.
17. Program co-chair for the Science of Design Principal Investigators workshop, February 28 to March 2, 2007.
18. Program co-coordinator for SOA Runtime area of the 4th International Conference on Service Oriented Computing Chicago, USA, December 4-7, 2006.
19. Program co-chair of the NSF/NCO Workshop on High-Confidence Software Platforms for Cyber-Physical Systems (HCSP-CPS) Workshop systems, November 30th to December 1st, 2006, Alexandria, VA.
20. Panels chair for the MoDELS 2006 conference, Genova Italy, Oct. 2-6, 2006.
21. Program Co-Chair of the Generative Programming and Component Engineering (GPCE) Conference, Portland, OR, October 2006 (collocated with OOPSLA '06).
22. Program Chair of the NSF/NCO Workshop on New Research Directions in High Confidence Software Infrastructure for Distributed Real-time and Embedded (DRE) systems, July 10th, 2006, Fairfax VA.
23. Program Co-Chair of the NSF/NCO High Confidence Medical Device Software and Systems (HCMDSS) Workshop, May 2005, University of Pennsylvania, Philadelphia, Pennsylvania.
24. Track Vice Chair for Real-time Middleware and Software Engineering for the Real-time Systems Symposium, Lisbon, Portugal, December, 2004.
25. Program Co-chair for the NSF/NCO Planning Meeting for the High Confidence Medical Device Software and Systems (HCMDSS) Workshop, November 16-17, 2004, Arlington, VA.
26. Program chair for 19th Annual ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOSPLA), October 24-28, 2004, Vancouver, British Columbia, Canada.
27. General co-chair of the IEEE Real-Time and Embedded Technology and Applications Symposium, May 25 – 28, 2004, Toronto, Canada.
28. Program chair of the CCM Workshop, December 10th, 2003, Nashville, TN.
29. General co-chair for the 5th International Symposium on Distributed Objects and Applications, November 3–7 2003, Catania, Sicily.
30. Program co-chair of the 3rd TAO Workshop, July 18, 2002, Arlington, VA.
31. Program co-chair for Middleware 2003, 4th IFIP/ACM/USENIX International Conference on Distributed Systems Platforms, June 16-20, 2003, Rio de Janeiro, Brazil.
32. Program co-chair for the 9th IEEE Real-time/Embedded Technology and Applications Symposium (RTAS), May 27-30, 2003, Washington, DC.
33. Area vice-chair and session chair for Middleware at the 23rd IEEE International Conference on Distributed Computing Systems (ICDCS), May 19-22nd, 2003, Providence, RI.
34. Program co-chair of the IEEE Workshop on LargeScale Real-Time and Embedded Systems, December 2, 2002, Austin, TX.

35. Program co-chair for the 4th International Symposium on Distributed Objects and Applications, October 28–November 1, 2002, Irvine, CA.
36. Co-organizer of the cross-agency Software Design and Productivity Coordinating Group Workshop on New Visions for Software Design and Productivity: Research and Applications, December 13-14, Nashville, TN.
37. Program co-chair for the 3rd International Symposium on Distributed Objects and Applications, September 18-20, 2001, Rome, Italy.
38. Co-organizer of the cross-agency Workshop on New Visions for Software Design and Productivity, April 18-19, 2000, Ballston, VA.
39. Area vice-chair and session chair for Middleware at the IEEE International Conference on Distributed Computing Systems, April 16-19, Phoenix, AZ, 2001.
40. Tutorial chair for the 6th USENIX Conference on Object-Oriented Technologies and Systems, January 27 - February 3, 2001, San Antonio, TX.
41. Co-chair of the OMG Workshop on Real-time and Embedded CORBA, in Reston, VA, July 24-27, 2000.
42. General chair of the IFIP/ACM International Conference Middleware 2000 in New York, April, 2000.
43. Tutorial chair for the 5^{th} USENIX Conference on Object-Oriented Technologies and Systems, May 3-7, 1999, San Diego, CA.
44. Treasurer for the Fourth International Workshop on Object-oriented Real-time Dependable Systems (WORDS'99) January 27-29, 1999, Radisson Hotel, Santa Barbara, California, USA.
45. Tutorial chair for the 4^{th} USENIX Conference on Object-Oriented Technologies and Systems, April 27-30, 1998, Santa Fe, New Mexico.
46. Co-chair of the mini-track on Engineering Client-Server Systems for the HICSS-31 conference, the Big Island of Hawaii - January 6-9, 1998.
47. Tutorial chair for the 3^{rd} USENIX Conference on Object-Oriented Technologies and Systems, Portland, OR, June 1997.
48. Publicity chair for the 5^{th} IEEE International Workshop on Object-Orientation in Operating Systems, IEEE TCOS and USENIX, Seattle, Washington, October 27-28, 1996.
49. Program chair for 3^{rd} conference on Programming Languages of Programming, Allerton, IL, USA, September, 1996.
50. Program chair for the 2^{nd} USENIX Conference on Object-Oriented Technologies, June 1996.

Professional Service and Advisory Positions

1. Member of the Fraunhofer Advisory Board for the University of Maryland, College Park.
2. Member of the steering committee for the Software Product-Line Conference series.
3. Member of the Future Airborne Capabilities Environment (FACE) Advisory Board.
4. Vice-Chair of the Cyber Situation Awareness study for the Air Force Scientific Advisory Board.
5. Member of the Joint Tactical Radio System (JTRS) Tiger Team in support of the Assistant Secretary of the Army, Acquisition, Logistics, and Technology.
6. Member of the Air Force Scientific Advisory Board.
7. Member of the advisory board for the NSF-sponsored Repository for Model-Driven Development (ReMoDD) project at Colorado State University.
8. Member of the National Academics Committee on Advancing Software-Intensive Systems Producibility, chaired by Bill Scherlis from Carnegie Mellon University (CMU).
9. Member of the Engineering and Methods Technical Advisory Group (TAG) for the Software Engineering Institute at Carnegie Mellon University (CMU) from 2006 to 2009.
10. Member of the Ultra-Large-Scale (ULS) Systems study commissioned by the US Army and conducted at the Software Engineering Institute at Carnegie Mellon University (CMU).

11. Member of the Joshua group, which is an advisory board for the Air Force Research Lab (AFRL) in Rome, NY.
12. Member of the steering committee for the Distributed Objects and Applications conference series.
13. Member of the steering committee for the ACM/USENIX/IFIP Middleware conference series.
14. Member of the steering committee for EMSOFT 2002: Second Workshop on Embedded Software, Grenoble, France, October, 7–9th, 2002.
15. Member of the steering committee for EMSOFT 2001: First Workshop on Embedded Software, Lake Tahoe, California, October, 8th–10th, 2001.
16. Member of the Board of Directors for the Embedded Systems Consortium for Hybrid and Embedded Research (ESCHER).
17. Member of the NASA/JPL Mars Science Laboratory Mission Concept Review Board.
18. Chair of the subcommittee on Embedded and Hybrid Systems program for the National Science Foundation's 2003 Committee of Visitors in the Computer and Communications Research (C-CR) Division.
19. Co-chair of the Software Design and Productivity (SDP) Coordinating Group of the Federal government's multi-agency Information Technology Research and Development (IT R&D) Program, the collaborative IT research effort of the major Federal science and technology agencies. The SDP Coordinating Group formulates the multi-agency research agenda in fundamental software design.
20. One of the three founding members of the Scientific Advisory Board for the *International Symposium of Distributed Objects and Applications* conference series.
21. Member of the advisory board for Entera, which provides Internet content delivery systems based on ACE.
22. Invited to participate in the OO Working Group of the "Strategic Directions in Computing Research" workshop sponsored by ACM at MIT in June 1996.

Technical Program Committees

1. The 3rd IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS 2022) held virtually from 19th to 23rd September 2022.
2. The 16th ACM International Conference on Distributed and Event-Based Systems, June 27 to July 1, 2022, Copenaghen, Denmark.
3. 8th International Workshop on Middleware and Applications for the Internet of Things (M4IoT), held in December 2021 in conjunction with the ACM/IFIP International Middleware Conference.
4. Middleware 2021 Doctoral Symposium, Dec. 6-10, 2021 in Quebec Canada.
5. The 2nd IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS 2021), September 27 to October 1, 2021, Washington DC, USA.
6. "Web of Things, Ubiquitous and Mobile Computing" Track for the Web Conference 2021, Ljubljana, Slovenia, from April 19-23, 2021.
7. 7th International Workshop on Middleware and Applications for the Internet of Things (M4IoT), December 2020 in conjunction with the ACM/IFIP International Middleware Conference.
8. 14th ACM International Conference on Distributed and Event-based Systems, July 13 to July 17, 2020, in Montreal, Quebec, Canada.
9. The Web Conference 2020: Web of Things, Ubiquitous, and Mobile Computing Track, April 20-24th, 2020, Taipei, Taiwan.
10. 6th Middleware for Context-Aware Applications in the IoT (M4IOT) workshop collocated with the ACM/IFIP/USENIX Middleware 2019 Conference, UC Davis, California, USA, December 9-13th 2019.
11. IEEE Workshop on IoT Big Data and Blockchain, at the 2019 IEEE International Conference on Big Data (IEEE Big Data 2019), December 9-12, 2019, Los Angeles, CA, USA.
12. The Second International Workshop on Blockchain Dependability, in conjunction with SRDS2019, Lyon, France, October 1, 2019.

13. The 13th ACM International Conference on Distributed and Event-based Systems, 4th-28th June, 2019, Darmstadt, Germany.
14. The "Web of Things, Ubiquitous, and Mobile Computing" track of The Web Conference 2019, San Francisco, CA, USA, May 13–17, 2019.
15. 17th Workshop on Adaptive and Reflexive Middleware (ARM), collocated with ACM/IFIP/Usenix Middleware 2018, December 10-14th, 2018, Rennes, France.
16. 25th International Conference on Pattern Languages of Programs (PLoP 2018), October 23 – 26th, Portland, OR, USA.
17. First International Workshop on Blockchain Dependability (WBD2018), held in conjunction with the 14th European Dependable Computing Conference, 10-14 September 2018, Iasi, Romania.
18. Workshop on Designing Resilient Intelligent Systems for Testability and Reliability, April 30 – May 4, 2018 in Seattle, USA (co-located with ICSA 2018).
19. 15th IEEE International Conference on Autonomic Computing (ICAC 2018), Sept 3-7, 2018, Trento, Italy.
20. International Conference on Information Society and Smart Cities (ISC 2018), Oxford city, United Kingdom 06-07 June, 2018.
21. 16th Workshop on Adaptive and Reflective Middleware workshop collocated with the ACM/IFIP/USENIX Middleware 2017 Conference, Las Vegas, Nevada, Dec 11-15, 2017.
22. 4th Middleware for Context-Aware Applications in the IoT (M4IOT) workshop collocated with the ACM/IFIP/USENIX Middleware 2017 Conference, Las Vegas, Nevada, Dec 11-15, 2017.
23. 10th International Workshop on Dynamic Software Product Lines - Adaptive Systems through Runtime Variability (DSPL '17), Sept 25-29, 2017, Sevilla, Spain.
24. 11th ACM International Conference on Distributed and Event-Based Systems (DEBS 2017), June 19 - 23, 2017, Barcelona, Spain.
25. 3rd Middleware for Context-Aware Applications in the IoT (M4IOT) workshop collocated with the ACM/IFIP/USENIX Middleware 2016 Conference, December 12-16, 2016 - Trento, Italy.
26. 7th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation, October 5th – 14th, 2016, Corfu, Greece.
27. 10th ACM International Conference on Distributed and Event-based Systems, June 20 to June 24, 2016 in Irvine, CA.
28. First International Workshop on Science of Smart City Operations and Platforms Engineering (SCOPE), April 11, 2016, Vienna, Austria (Co-located with CPS Week).
29. 9th Dynamic Software Product Lines (DSLP) 2015 (held as part of SASO 2015) at MIT on September 21, 2015.
30. 13th International Conference on Advances in Mobile Computing and Multimedia (MoMM2015), Brussels, Belgium from 10-12 December 2015.
31. 13th IEEE/IFIP International Conference on Embedded and Ubiquitous Computing (EUC 2015, track on Cyber Physical Systems, Porto Portugal, October 21-23, 2015.
32. 35th IEEE International Conference on Distributed Computing Systems (ICDCS), June29 - July 2, 2015 in Columbus, Ohio, USA.
33. Fourth International Conference on Emerging Applications of Information Technology (EAIT) at Indian Statistical Institute, Kolkata, India, December 19-21, 2014.
34. The 20th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2014), Berlin, Germany, April 2014.
35. International Conference on Model-Driven Engineering and Software Development (MODELSWARD 2014), Lisbon, Portugal, 7-9 January, 2014.
36. 14th ACM/IFIP/USENIX International Middleware Conference (Middleware 2013), December 9-13, Beijing, China.
37. 32nd International Symposium on Reliable Distributed Systems (SRDS 2013), September 30-October 3, 2013 at Braga, Portugal.

38. 17th International Software Product Line Conference SPLC, Tokyo, Japan, 26-30 August 2013.
39. First International Workshop on Engineering Mobile-Enabled Systems, in conjunction with ICSE 2013, May 18-26th, 2013, San Francisco, CA.
40. International Conference on Model-Driven Engineering and Software Development (MODELSWARD 2013), Barcelona, Spain, 19-21 February, 2013.
41. ACM/USENIX/IFIP International Middleware conference, Montreal, Quebec, Canada, December 3-7, 2012.
42. 11th Workshop on Adaptive and Reflective Middleware, in conjunction with Middleware 2012 in Montreal, Quebec, Canada, December 3-7, 2012.
43. International Workshop on Real-Time and Distributed Computing in Emerging Applications (REACTION) 2012, San Juan, Puerto Rico, December 4, 2012, in co-location with the 33rd IEEE Real-Time Systems Symposium.
44. Third International Conference on Emerging Applications of Information Technology (EAIT) November 29 - December 01, 2012, Kolkata, India.
45. IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS), Las Vegas, USA, November 12 - 14, 2012.
46. 31st International Symposium on Reliable Distributed Systems (SRDS), 8th-11th October 2012. Irvine, California.
47. Sixth International Workshop on Dynamic Software Product Lines (DSPL), September 2 - 7, 2012, Salvador, Brazil.
48. 16th International Software Product Line Conference (SPLC 2012), Salvador, Brazil on 02-07 September 2012.
49. 5th International workshop UML and Formal Methods (UML&FM 2012), Paris, France, August 27-31, 2012.
50. UML&AADL 2012, July 18-20,2012, Ecole Normale Superieure, Paris, France.
51. 17th IEEE International Conference on Engineering of Complex Computer Systems (ICECCS 2012), July 18-20,2012, Ecole Normale Superieure, Paris, France.
52. COMPSAC 2012 - Trustworthy Software Systems for the Digital Society, July 16-20, 2012, Izmir, Turkey.
53. Foundations Track of the 8th European Conference on Modelling Foundations and Applications (ECMFA 2012), Copenhagen, Denmark, 2-6th of July, 2012.
54. 24th International Conference on Software Engineering and Knowledge Engineering, Redwood City, California, USA, July 1-3, 2012.
55. 12th IFIP International Conference on Distributed Applications and Interoperable Systems (DAIS'12), Stockholm, Sweden, 13-16 June 2012.
56. 15th IEEE International Symposium on Object and component-oriented Real-time distributed Computing (ISORC), April 11-13, 2012, Shenzhen, China.
57. 23rd IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2011), Dallas, USA, December 14 to 16, 2011.
58. Fourth IEEE International Workshop on Real-Time Service-Oriented Architecture and Applications (RTSOAA 2011), December 12th–14th 2011, University of California, Irvine, CA.
59. ACM/IFIP/USENIX International Middleware Conference, Lisbon, Portugal, December 12th to 16th, 2011.
60. 9th International Conference on Advances in Mobile Computing and Multimedia (MoMM2011), Hue City, Vietnam, 05-07 December 2011.
61. Control Systems, Automation and Robotics track of the 3rd International Congress on Ultra Modern Telecommunications and Control Systems (ICUMT 2011), Hungary on October 5-7, 2011.
62. 15th IEEE International Enterprise Distributed Object Computing Conference (EDOC 2011), August 29th - September 2nd, 2011, Helsinki, Finland.

63. 15th International Software Product Line Conference (SPLC 2011), Research/Experience Track, Munich, Germany, August, 22-26, 2011.
64. 15th International Software Product Line Conference (SPLC 2011), Industry Track, Munich, Germany, August, 22-26, 2011.
65. 2nd Workshop on Formal Methods in Software Product Line Engineering - Munich (Germany), August 2011.
66. 23rd International Conference on Software Engineering and Knowledge Engineering (SEKE2011), Miami Beach, USA, July 7-9, 2011.
67. 2nd International Workshop on Analysis Tools and Methodologies for Embedded and Real-time Systems, July, 5th 2011, Porto, Portugal.
68. Fourth IEEE International workshop UML and Formal Methods, co-located with FM 2011, June 20th, 2011, Lero, Limerick, Ireland.
69. The Software Engineering and Data Engineering (SEDE 2011) conference, Las Vegas, Nevada, June 20-22, 2011.
70. 3rd International Workshop on Model-Driven Architecture and Modeling-Driven Software Development (MDA&MDSD 2011) in conjunction with the 6th International Conference on Evaluation of Novel Approaches to Software Engineering - ENASE 2011, Beijing Jiaotong University, 8-11, June 2011.
71. 11th International IFIP Conference on Distributed Applications and Interoperable Systems (DAIS 2011), Reykjavik, Iceland, June 6-9 2011.
72. Second Product LinE Approaches in Software Engineering (PLEASE) workshop, collocated with 33rd International Conference on Software Engineering, Waikiki, Honolulu, Hawaii, May 21-28, 2011.
73. 16th Annual IEEE International Conference on the Engineering of Complex Computer Systems (ICECCS), April 27th-29th, 2011 Las Vegas, NV, USA.
74. Sixth IEEE International workshop UML and AADL, in conjunction with ICECCS 2011, April 27th, 2011, Las Vegas, USA.
75. First International Workshop on Cyber-Physical Networking Systems (CPNS'2011), in conjunction with INFOCOM 2011, April 15, 2011, Shanghai, China.
76. 2nd Workshop on Model Based Engineering for Embedded System Design (M-BED 2011), colocated with the Design, Automation, and Test in Europe (DATE) conference, 14-18, March, 2011, Grenoble, France.
77. Second International Conference on Emerging Applications of Information Technology (EAIT 2011), February, 2011 at Kolkata, India.
78. Fifth International Workshop on "Variability Modeling of Software-intensive Systems" (VaMoS '11), January 27-29 2011 in Namur, Belgium.
79. 9th Workshop on Adaptive and Reflective Middleware (ARM 2010) November 27, 2010, Bangalore India, collocated with Middleware 2010.
80. The 22nd IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2010), November 8-10, 2010, Marina Del Ray, California.
81. International Conference on Software Engineering, Management, and Application (ICSEMA 2010) Kathmandu, Nepal, October 29th and 30th, 2010.
82. The MobiCPS 2010 workshop, held in conjunction with the 7th International Conference on Ubiquitous Intelligence and Computing (UIC2010), October 26-29, 2010 Xian, China.
83. Fourteenth IEEE International Enterprise Computing Conference (EDOC 2010), 25-29 October 2010, Vitoria, ES, Brazil.
84. Advances in Business ICT (ABICT) 2010 Workshop Wisla, Poland, October 18-20, 2010.
85. 3rd Workshop on Model Based Architecting and Construction of Embedded Systems (ACES-MB), held in conjunction with MoDELS 2010, Oslo, Norway, October 3-8, 2010.
86. 4th Dynamic Software Product Line Workshop held in conjunction with the 14th International Software Product Line Conference 2010, Jeju Island, South Korea, September 13-17, 2010.

87. TOOLS Europe 2010, Malaga, Spain, June 28 to July 2, 2010.
88. 22nd International Conference on Software Engineering and Knowledge Engineering (SEKE'2010), to be held July 1-3, 2010, Redwood City, California.
89. 13th International Symposium on Component Based Software Engineering (CBSE 2010), June 23-25 2010 in Prague, Czech Republic.
90. Sixth European Conference on Modelling Foundations and Applications (ECMFA), University of Pierre & Marie Curie, Paris, France. June 15-18, 2010.
91. 10th IFIP WG 6.1 International Conference on Distributed Applications and Interoperable Systems (DAIS), Amsterdam, The Netherlands, June 7-9, 2010.
92. The 11th OMG Real-time/Embedded CORBA workshop, Washington DC, May 24-26, 2010.
93. Industrial track at the 32nd International Conference on Software Engineering (ICSE 2010), Cape Town (South Africa), May 2-8, 2010.
94. Thirteeth International Conference on Business Information Systems (BIS 2010), Berlin, Germany, May 3-5 2010.
95. 1st International Workshop on Product LinE Approaches in Software Engineering, May 2nd, 2010, Cape Town, South Africa, held in conjunction with the 32nd International Conference on Software Engineering (ICSE 2010).
96. Workshop on Effective Multicasting for Future Critical Networked Systems (EMFINES 2010), at the Eighth European Dependable Computing Conference (EDCC), Valencia, Spain, April 28-30, 2010.
97. 1st Workshop on Model-Based Engineering for Embedded Systems Design, co-located with DATE 2010, March 12, 2010 in Dresden, Germany.
98. IEEE International Conference on Engineering of Complex Computer Systems (ICECCS 2010), Oxford 22-26, March 2010.
99. Special session on "Advanced Peer-to-Peer Protocols and Applications" at the Ninth IASTED International Conference on Parallel and Distributed Computing and Networks (PDCN 2010) February 16-18, 2010 Innsbruck, Austria.
100. Fourth Variability Modelling of Software-intensive Systems (VaMoS '10) workshop, Linz, Austria - January 27-29, 2010.
101. 8th Workshop on Adaptive and Reflective Middleware (ARM'09), in collocation with the 10th ACM/IFIP/USENIX Middleware Conference, in Urbana Champaign, Illinois, November 30th, 2009.
102. Workshop committee for OOPSLA 2009, Orlando Floria, October 25-29, 2009.
103. The ARTIST 2nd International Workshop on Model Based Architecting and Construction of Embedded Systems (ACESMB 2009), in conjunction with the 12th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS 2009), October 6th, 2009, Denver, Colorado.
104. The Thirteenth IEEE International EDOC Conference (EDOC 2009), 31 August - 4 September 2009, Auckland, New Zealand.
105. The 10th OMG Real-time/Embedded CORBA workshop, Washington DC, July 13–15, 2009.
106. The Software Engineering and Knowledge Engineering (SEKE'2009) conference, July 1-3, 2009, Boston, MA.
107. 12th International Symposium on Component-Based Software Engineering (CBSE 2009), East Stroudsburg University, Pennsylvania, USA, June 22-25, 2009.
108. The Second International Workshop on Cyber-Physical Systems (WCPS2009), held in conjunction with IEEE ICDCS 2009 in Montreal, Canada, June 22, 2009.
109. The Fifth European Conference on Model Driven Architecture Foundations and Applications (ECMDA), Gdansk, Poland, summer of 2009.
110. The 9th IFIP International Conference on Distributed Applications and Interoperable Systems (DAIS 2009) conference, Lisbon, Portugal, June 9-11, 2009.

111. The Fourth International Conference on COMmunication System softWAre and middlewaRE (COMSWARE), 15th - 19th June 2009, Trinity College Dublin, Ireland.
112. The UML&AADL Workshop, held in conjunction with ICECCS 2009 The fourteenth IEEE International Conference on Engineering of Complex Computer Systems June 02, 2009, Potsdam, Germany.
113. The 15th Real-time and Embedded Applications Symposium (RTAS) 2009, Track B, Real-time and Embedded Applications, Benchmarks and Tools, San Francisco, CA, United States, April 13 - 16, 2009.
114. Member of the ISORC 2009 advisory and publicity committee for ISORC 2009, March 17-20, 2009, Toyko, Japan.
115. the 13th International Software Product Line Conference (SPLC), August 24-28, 2009, San Francisco, CA.
116. the European Conference on Model Driven Architecture - Foundations and Applications 2009, University of Twente, Netherlands, June 2009.
117. The third workshop on "Variability Modelling of Software-intensive systems" (VaMoS'09), January 28-30 2009 in Sevilla, Spain.
118. the 1st Workshop on Software Reuse Efforts, November 27-29, 2008 Brazil.
119. the 7th Workshop on Adaptive and Reflective Middleware (ARM'08) in collocation with the 9th ACM/IFIP/USENIX Middleware Conference, Leuven, Belgium, December 1st 2008.
120. the Middleware 2008 9th International Middleware Conference, December 1-6, 2008, Leuven, Belgium.
121. the 11th Component-Based Software Engineering conference, Karlsruhe, Germany, October 14-17, 2008.
122. the ARTIST International Workshop on Model Based Architecting and Construction of Embedded Systems (ACESMB 2008), in conjunction with the 11th ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS 2008), Toulouse, September 29th, 2008.
123. the 6th Java Technology for Real-Time and Embedded Systems (JTRES) conference, Santa Clara, California, USA, 24-26 September, 2008.
124. the 12th IEEE International Enterprise Distributed Computing Conference (EDOC) (EDOC 2008), 15-19 September 2008, Munich, Germany.
125. the First Workshop on Analyses of Software Product Lines (ASPL'08), September 12, 2008 in Limerick, Ireland in conjunction with SPLC'08.
126. the 9th OMG Real-time/Embedded CORBA workshop, Washington DC, July 14–17, 2008
127. the 3rd International Conference on Software and Data Technologies, July 5-8, 2008, Porto, Portugal.
128. the 20th International Conference on Software Engineering and Knowledge Engineering (SEKE'08), Redwood City, California, USA, July 1-3, 2008.
129. the TOOLS EUROPE 2008 conference, June 30 to July 4, 2008 at ETH Zurich.
130. National Conference on Research & Development in Hardware & Systems (CSI-RDHS 2008), Computer Society of India Kolkata Chapter & CSI Division I (Hardware & Systems), June 20-21, 2008, Kolkata, India.
131. the First International Workshop on Cyber-Physical Systems, Beijing, China, June 17 - 20, 2008.
132. the ECMDA 2008 (Fourth European Conference on Model Driven Architecture Foundations and Applications) in Berlin, June 09 - 12, 2008.
133. the Distributed Applications and Interoperable Systems (DAIS), Oslo, Norway, June 4, 2008.
134. the 2nd International Workshop on Ultra-Large-Scale Software-Intensive Systems (ULSSIS 2008), May 10-11, 2008 Leipzig, Germany.
135. the Automotive Systems Track at the 30th International Conference on Software Engineering (ICSE), Leipzig, Germany, 10-18 May 2008.

136. the Real-Time and embedded Applications / Benchmarks track at the 14th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2008), St. Louis, MO, April 22-24, 2008.
137. the 3rd UML and AADL Workshop held in conjunction with the 13th IEEE International Conference on Engineering of Complex Computer Systems, Belfast, Northern Ireland, 31 March - 4 April 2008.
138. the ACM Programming for Separation of Concern track at SAC 2008, Fortaleza, Brazil, March 16 - 20, 2008.
139. the 6th edition of the International Workshop on Adaptive and Reflective Middleware, held in conjunction with Middleware 2007 in Newport Beach, California.
140. the IEEE/ACM/USENIX Middleware conference, November 2007.
141. the IASTED International Conference on Parallel and Distributed Computing and Systems, PDCS 2007, Cambridge, MA, USA from Nov 19-21, 2007.
142. the 9th International Symposium on Distributed Objects, Middleware, and Applications (DOA), Iberian peninsula and islands, Oct 28 - Nov 2, 2007.
143. Member of the Doctoral Symposium committee at OOPSLA 2007, Portland, OR October 21-25, 2007.
144. the International Symposium on Ambient Intelligence and Computing, October 2007, Korea.
145. the IEEE conference on Enterprise Distributed Object Computing (EDOC), Annapolis, MD, October 15-19, 2007.
146. the 5th Java Technology for Real-Time and Embedded Systems (JTRES), Vienna, Austria, 26-28 September, 2007.
147. the Workshop on Trade-Off analysis of Software Quality Attributes (TOSQA), collocated with the sixth joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering, Dubrovnik, Croatia, September 3-7, 2007.
148. the 2nd International Conference on Software and Data Technologies, July 22-25th 2007, Barcelona, Spain.
149. the Fourth IEEE International Conference on Web Services, Salt Lake City, UT, July 9-13, 2007.
150. the 10th International Component-Based Software Engineering (CBSE) Symposium, Boston, MA, July 9-11 2007.
151. the 8th OMG Real-time/Embedded CORBA workshop, Washington DC, July 9–12, 2007.
152. the International Conference TOOLS EUROPE 2007, Zurich, Switzerland on June, 24-28 2007.
153. the track on "Real-Time and Embedded Applications and Benchmarks" for the 13th IEEE Real-Time and Embedded Technology and Applications Symposium, Bellevue, WA, April 3 - April 6, 2007.
154. the Workshop on the Foundations of Interactive Computation (FInCo 2007), Braga, Portugal, March 24 - April 1, 2007.
155. the 15th International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS), Long Beach, California, 26-27 March, 2007.
156. the ACM Symposium on Applied Computing, Programming for Separation of Concerns track, Seoul, Korea, March 11 - 15, 2007.
157. the Workshop on Pervasive Computing Environments and Services (PCES 07), Naples, Italy, Feb 7-9, 2007.
158. the Minitrack on Components for Embedded and Real-time Systems at the 40th Hawaiian International Conference on System Sciences, January 3-6, 2007 at Waikoloa, Big Island, Hawaii.
159. the 13th Asia Pacific Software Engineering Conference (APSEC06), Bangalore, India, Dec 6-8, 2006.
160. the Real-time Middleware and Software Engineering track of the The 27th IEEE Real-Time Systems Symposium, December 5-8, 2006 Rio de Janeiro, Brazil.

161. the 2nd International Conference on Trends in Enterprise Application Architecture, November 29th to December 1st, 2006, Berlin, Germany.
162. the workshop on MOdel Driven Development for Middleware (MODDM), November 27, 2006, Melbourne, Australia.
163. the International Symposium on Distributed Objects and Applications (DOA), Montpellier, France, Oct 29 - Nov 3, 2006.
164. the "Library-Centric Software Design" (LCSD'06) workshop at the OOPSLA'06 conference in Portland, Oregon, October 22-26, 2006.
165. Judge for the Student Research Competition at OOPSLA 2006, Portland, OR, October 23-24, 2006.
166. the NSF Workshop On Cyber-Physical Systems, October 16 - 17, 2006, Austin, Texas.
167. the Models at Run-Time MaRT-06 workshop held at the MoDELS 2006 conference, Genova Italy, Oct. 2-6, 2006.
168. the MoDELS 2006 conference, Genova Italy, Oct. 2-6, 2006.
169. the 7th OMG Real-time/Embedded CORBA workshop, Washington DC, July 11–14, 2006.
170. the European Conference on Object-Oriented Programming, Nantes, France, July 3-7, 2006.
171. the 9th International Symposium on Component-Based Software Engineering (CBSE 2006), Malardalen University, Sweden, June 29th-1st July 2006.
172. the 28th International Conference on Software Engineering (ICSE 28), May 24-26, 2006, Shanghai, China.
173. the 14th International Workshop on Parallel and Distributed Real-Time Systems, April 25-26, 2006, Island of Rhodes, Greece.
174. the 9th IEEE International Symposium on Object-oriented Real-time Distributed Computing, April 24-26, 2006, Gyeongju, Korea.
175. the Automotive Software Workshop San Diego (ASWSD 2006), University of California, San Diego, March 15-17, 2006.
176. the C++ Connections: 20 Years of C++ conference, Nov 7-11, 2005, Mandalay Bay, Las Vegas, NV.
177. the Conference on Distributed Objects and Applications (DOA 2005), Oct 31 - Nov 4, 2005, Agia Napa, Cyprus.
178. the 20th Annual ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOSPLA), October 16-20, 2005, San Diego, CA, USA.
179. the 6th International Conference on Middleware (Middleware'2005), October, 2005, Grenoble, France.
180. the 2005 Monterey Workshop on Networked Systems, Laguna Beach, California, September 22-24, 2005.
181. The 12th Pattern Language of Programs (PLoP 2005), September 7-10, 2005, Allerton Park, Monticello, Illinois, USA.
182. the 14th IEEE International Symposium on High-Performance Distributed Computing (HPDC-14), Research Triangle Park, North Carolina, July 27, 2005.
183. the 5th International Workshop on Software and Performance (WOSP 2005), Palma de Mallorca, Spain, July 11-15, 2005.
184. the 6th OMG Real-time/Embedded CORBA workshop, Washington DC, July 11–14, 2005.
185. the 5th IFIP WG 6.1 International Conference on Distributed Applications and Interoperable Systems (DAIS 2005), June 15-17, 2005, Athens, Greece.
186. the International Conference on Autonomic Computing (ICAC 2005), Seattle, WA, June 2005.
187. the International Symposium on Component-Based Software Engineering (CBSE), co-located with the International Conference on Software Engineering (ICSE), May 14-15, 2005, St. Louis, MO.

188. the Foundations of Interactive Computation (FINCO'05) Workshop, Saturday, 9 April 2005, in Edinburgh, Scotland.
189. the Embedded Applications track of the IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS) 2005, San Francisco, California, March 2005.
190. the "Programming for Separation of Concerns" track at Symposium on Applied Computing (SAC 2005), Santa Fe, New Mexico, March 2005.
191. the 12th International Symposium on the Foundations of Software Engineering, November 6th, 2004, Newport Beach, California.
192. the Conference on Distributed Objects and Applications (DOA 2004), October 25-29, 2004 in Cyprus, Greece.
193. the 2nd International Workshop on Java Technologies for Real-Time and Embedded Systems (JTRES), October 25-29, 2004, Larnaca, Cyprus.
194. the 3rd Workshop on Reflective and Adaptive Middleware (RM2004), October 19, 2004, Toronto, Ontario, Canada.
195. the Middleware 2004 5th IFIP/ACM/USENIX International Conference on Distributed Systems Platforms, October 18-22, 2004, Toronto, Canada.
196. the 4th TAO+CIAO Workshop, Arlington, VA, July 16, 2004.
197. the DARPA Workshop on Java in Real-Time and Embedded Defense Applications, Arlington, VA, July 13, 2004.
198. the OMG Real-time/Embedded CORBA workshop, Crystal City, VA, July 12–15, 2004.
199. the ECOOP 2004 conference, June 14-18, 2004, Oslo, Norway.
200. the Middleware track of the 24th IEEE International Conference on Distributed Computing Systems (ICDCS), May 23-26, 2004, Tokyo, Japan.
201. the 2nd International Workshop on Remote Analysis and Measurement of Software Systems (RAMSS), Edinburgh, Scotland, UK, May 24, 2004.
202. Aspect-Oriented Software Development conference, Lancaster, England, March 22-26, 2004.
203. the SPIE/ACM Conference on Multimedia Computing and Networking, January 21-22, 2004 Santa Clara, California.
204. the Real-time Systems Symposium (RTSS), Cancun, Mexico, December 3-5, 2003.
205. the 4th IFIP International Conference on Distributed Applications and Interoperable Systems (DAIS), Paris - France November 17-21, 2003.
206. the International Workshop on Java Technologies for Real-Time and Embedded Systems (JTRES), November 3-7, 2003, Catania, Sicily, Italy.
207. the Domain Driven Development track at the OOPSLA 2003 18th Annual ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages, and Applications, October 26-30, 2003, Anaheim, California, USA.
208. the OOPSLA 2003 18th Annual ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages, and Applications, October 26-30, 2003, Anaheim, California, USA.
209. External reviewer for the 2nd Generative Programming and Component Engineering (GPCE '03) conference, Erfurt, Germany, September 22-25, 2003.
210. the OMG Real-time/Embedded CORBA workshop, Crystal City, VA, July 14–17, 2003.
211. the The 2nd Workshop on Reflective and Adaptive Middleware, Rio de Janeiro, Brazil, June 17, 2003.
212. the ACM SIGPLAN 2003 Conference on Programming Language Design and Implementation (PLDI), San Diego, California, June 9 - 11, 2003.
213. the 1st International Workshop on Remote Analysis and Measurement of Software Systems (RAMSS), Portland, Oregon, May 9, 2003.
214. External reviewer for the 17th International Parallel and Distributed Processing Symposium, April 22–26, 2003, Nice, France.

215. the ACM International Conference on Aspect-Oriented Software Development, March 17 - 21, 2003, Boston, MA.
216. the SPIE/ACM Conference on Multimedia Computing and Networking, Santa Clara, California, January 29–31, 2003.
217. the International Workshop on Product Line Engineering The Early Steps: Planning, Modeling, and Managing (PLEES '02), Seattle, WA, November 5, 2002.
218. the 8th IEEE Real-Time and Embedded Technology and Application Symposium (RTAS), San Jose, CA, September 24-27, 2002.
219. the 9th Conference on Pattern Language of Programs, Allerton Park, IL, September 8-12, 2002.
220. the Workshop on Dependable Middleware-Based Systems, held as a part of DSN 2002, Washington, D.C., June 23-36, 2002.
221. the 2nd TAO Workshop, Arlington, VA, July 19, 2002.
222. the OMG Real-time/Embedded CORBA workshop, Crystal City, VA, July 15–18, 2002.
223. the 16th European Conference on Object-Oriented Programming, University of Malaga, Spain June 10-14, 2002.
224. the Tenth International Workshop on Quality of Service (IWQoS), May 15-17, 2002, Miami Beach, Florida.
225. the International Symposium on Object-Oriented Real-time Distributed Computing (ISORC), Washington DC, April 29 – May 1, 2002.
226. the Seventh IEEE International Workshop on Object-oriented Real-time Dependable Systems (WORDS 2002), January 7-9, 2002, San Diego, CA.
227. the International Workshop on Multimedia Middleware October 5th, 2001, Ottawa, Canada.
228. the OMG Workshop on Real-time and Embedded CORBA, in Reston, VA, June 4-6, 2001.
229. the USENIX 2001 conference, Boston, MA, June 25-30, 2001.
230. the International Symposium on Object-oriented Real-time Distributed Computing (ISORC), May 2-4, Magdenburg, Germany, 2001.
231. the 6th USENIX Conference on Object-Oriented Technologies and Systems, January 27 - February 3, 2001, San Antonio, TX.
232. External reviewer for OOPSLA 2000, Minneapolis, MN, October 2000.
233. the 3rd IFIP International Conference on Trends towards a Universal Service Market (USM'2000), September 12-14, 2000.
234. the International Symposium on Distributed Objects and Applications (DOA '00), OMG, Antwerp, Belgium, September 2000.
235. the ACM SIGCOMM 2000, Stockholm, Sweden, August 30 to September 1st, 2000.
236. the Pattern Languages of Programming (PLoP) conference, Monticello, Illinois, August, 2000.
237. the 9th IEEE International Conference on High-Performance Distributed Computing, August, 2000.
238. the "International Workshop on Software Engineering for Parallel and Distributed Systems" (PDSE 2000), at the 22nd International Conference on Software Engineering (ICSE-2000), in Limerick, Ireland in June, 2000.
239. the 6th IEEE Real-Time Technology and Application Symposium (RTAS), May 17-19, 2000, Washington DC, USA.
240. the 1999 ACM OOPSLA conference, Denver, Colorado, November 1-5, 1999.
241. the IFIP Sixth International Workshop on Protocols For High-Speed Networks (PfHSN '99), Wednesday August 25 – Friday August 27, 1999 Salem, MA.
242. the 1999 IEEE Real-Time Technology and Applications Symposium (RTAS99), Vancouver, British Columbia, Canada, June 2-4, 1999.
243. the 5th USENIX Conference on Object-Oriented Technologies and Systems, May 3-7, 1999, San Diego, CA.

244. Technical workshop committee for the International Software Architecture workshop, ACM SIGSOFT's FSE9 conference in Orlando FL, November 1-5, 1998.
245. the workshop on Software and Performance (WOSP98), Santa Fe, New Mexico, Oct 12-16 1998.
246. the IFIP International Conference on Distributed Systems Platforms and Open Distributed Processing: Middleware '98. September 15-18 1998, The Lake District, England.
247. the TOOLS USA'98 conference. Santa Barbara, California, August 3 - 7, 1998.
248. the IEEE High Performance Distributed Computing conference, Chicago, IL, July 28-31, 1998.
249. 12^{th} European Conference on Object-Oriented Programming, Brussels, Belgium, July 20 - 24, 1998.
250. the 3rd EuroPLoP conference, Kloster Irsee, Germany, July 9-11, 1998.
251. the IEEE International Conference on Configurable Distributed Systems (ICCDS '98), Annapolis, MD, May 4-6, 1998.
252. the IEEE IWQoS '98 in Napa Valley, CA, May 18-20, 1998.
253. the 4th USENIX Conference on Object-Oriented Technologies and Systems, April 26-29, 1998, Santa Fe, New Mexico.
254. the 3^{rd} International Workshop on Software Engineering for Parallel and Distributed Systems, at the 20th International Conference on Software Engineering (ICSE-20), in April 20-21, Kyoto, Japan.
255. the IEEE Conference on Open Architectures and Network Programming, April 3-4, 1998, San Francisco, CA.
256. the Workshop on Middleware for Real-Time Systems and Services, held in conjunction with IEEE Real-time Systems Symposium, December 2nd, San Francisco, California.
257. the Open Signaling for ATM, Internet and Mobile Networks. October 6th and 7th, 1997, Columbia University, New York, NY.
258. the 24^{th} International Conference on Technology of Object-Oriented Languages and Systems (TOOLS Asia '97). Beijing, China, September 22 - 25, 1997.
259. the 4^{th} Pattern Languages of Programming conference, Allerton Park, Illinois, September 3-5, 1997.
260. the 3^{rd} USENIX Conference on Object-Oriented Technologies and Systems, Portland, June 16-19th 1997.
261. Session chair of the Patterns technical paper session at ECOOP '97, June 13th, 1997.
262. the 1997 European Conference on Object-Oriented Programming (ECOOP), June 9-13, 1997, Jyvskyl, Finland.
263. Chair of the technical session on "Distributed Object Computing" for the IFIP/IEEE Fifth International Workshop on Quality of Service (IWQoS '97).
264. the 2^{nd} International Workshop on Software Engineering for Parallel and Distributed Systems, at the 19^{th} International Conference on Software Engineering (ICSE-19) Sheraton Boston Hotel and Towers, Boston, Massachusetts, USA, May 19 and 20, 1997.
265. the 3^{rd} USENIX Conference on Object-Oriented Technologies and Systems, Portland, 1997.
266. the 5^{th} IEEE International Workshop on Object-Orientation in Operating Systems, IEEE TCOS and USENIX, Seattle, Washington, October 27-28, 1996.
267. the 1997 ACM SIGCOMM conference, Cannes, French Riviera, France, September 1997.
268. the 1997 IEEE INFOCOM conference, Kobe, Japan, April 1997.
269. the 1996 IEEE INFOCOM conference, San Francisco, CA, USA, March 24-28, 1996.
270. the 1995 IEEE INFOCOM conference, Boston, Massachusetts, USA, April, 1995.
271. the 3^{rd} IEEE workshop on Architecture and Implementation of High Speed Communication Subsystems (HPCS '95), held in Mystic, Connecticut, August 1995.
272. the 8^{th} IFIP International Working Conference on Upper Layer Protocols, Architectures, and Applications, held in Barcelona, Spain, June 1 to 3, 1994.

Workshops and Panels Organized

1. Co-organized the 1st International Workshop on Data Dissemination for Large scale Complex Critical Infrastructures (DD4LCCI 2010), at the Eighth European Dependable Computing Conference, Valencia, Spain, April 28-30, 2010.
2. Co-organized the OOPSLA Jeopardy panel at OOPSLA 2009, Orlando Floria, October 25-29, 2009.
3. Co-organized a workshop entitled First International Workshop on Software Technologies for Ultra-Large-Scale (ULS) Systems at 29th Int. Conference on Software Engineering, May 20-29th, Minneapolis, MN, 2007.
4. Co-organized a session on architectures, platforms, and standards for QoS-enabled dissemination at the Systems and Information Interoperability Meeting, Oct 25-27, 2006 at the Minnowbrook Conference Center, Blue Mountain Lake, NY.
5. Co-organized a workshop entitled "Breathturn: Ultra Large Scale Systems" at OOPSLA 2006, October 26, 2006, Portland, OR.
6. Co-chair of the NSF workshop on open-source Middleware for Distributed Real-time and Embedded Systems, 7th OMG Real-time/Embedded CORBA workshop, Arlington, VA, July 10–13, 2006.
7. Organized and led a session on architectures, platforms, and standards for real-time tactical information management at the Systems and Information Interoperability Meeting, Oct 18-21, 2005 at the Minnowbrook Conference Center, Blue Mountain Lake, NY.
8. Co-organizer of the technical workshops program at OOPSLA 2005, San Diego, October 16th-20, 2005.
9. Co-organizer for the MODELS 2005 workshop on "MDD for Software Product-lines: Fact or Fiction?," October 2, 2005, Jamaica.
10. Co-organizer of the OOPSLA '02 workshop on "Patterns in Distributed Real-Time and Embedded Systems", Seattle, WA, November, 2002.
11. Co-organizer of the OOPSLA '01 workshop on "Towards Patterns and Pattern Languages for OO Distributed Real-time and Embedded Systems" Tampa Bay, FL, October 14, 2001.
12. Organizer and chair of a panel on real-time extensions to OO middleware, OPENSIG Fall '97 workshop on Open Signaling for ATM, Internet and Mobile Networks Columbia University, October 6-7 1997, New York, NY.
13. Co-organizer of a workshop for the 1997 European Conference on Object-Oriented Programming entitled CORBA: Implementation, Use, and Evaluation, Jyvaskyla, Finland, June 10th, 1997.
14. Organizer and chair of a panel on "QoS and Distributed Systems Platforms" for the IFIP Fifth International Workshop on Quality of Service (IWQoS '97), May 22-24th, 1997, Columbia University, New York.
15. Co-organizer of the OOPSLA '95 workshop on "Patterns for Concurrent, Parallel, and Distributed OO Systems."
16. Co-facilitator of the ECOOP '95 workshop workshop on Pattern Languages of Object-Oriented Programs, Aarhus, Denmark, August 1995.

Reviewer for Professional Submittals

Reviewed papers for the following journals, conferences, books, and grant review processes:

1. Reviewer for COVID-19 proposals to the C3.ai Digital Transformation Institute.
2. *The 21st IEEE International Symposium on Real-time Computing (ISORC)*, Nanyang Technological University, Singapore, 29th - 31st May 2018.
3. *Future Generation Computer Systems*, Elsevier, edited by Aniruddha Gokhale et al., 2016.
4. *IEEE Software*, Special Issue on Next Generation Mobile Computing, edited by James Edmondson et al., 2013.
5. *Software Testing in the Cloud*, edited by Scott Tilley, 2012.
6. Elsevier Information & Software Technology special issue on Software Reuse and Product Lines, 2012.
7. The 2010 Military Communications Conference, Cyber Security and Network Management, San Jose, CA, October 31-November 3, 2010.

8. *Model-Driven Domain Analysis and Software Development: Architectures and Functions*, edited by Janis Osis and Erika Asnina, 2010.
9. Reviewer for the book "Patterns for Parallel Software Design," by Jorge L. Ortega Arjona, Wiley, 2010.
10. Special Issue on Industrial Applications of Aspect Technology for the journal Transactions on Aspect-Oriented Software Development (TAOSD), 2009.
11. *Software Engineering for Self-Adaptive Systems*, edited by Betty H. C. Cheng, Rogerio de Lemos, Holger Giese, Paola Inverardi, and Jeff Magee, Springer, 2009.
12. Special issue on Service Oriented Computing for the ACM Transactions on the Web journal, 2008.
13. Special Issue in Software Reuse: Methods, Processes, Tools and Experiences for the Journal of the Brazilian Computer Society (JBCS), 2007
14. Designing Software-Intensive Systems: Methods and Principles book, 2008
15. Special issue on Patterns for the IEEE Software, 2007
16. IEEE Internet Computing Magazine, 2006.
17. IEEE Transactions on Parallel and Distributed Systems, 2004
18. International Journal of Software Process: Improvement and Practice Special issue - Software Variability: Process and Management
19. IEEE Internet Computing Magazine
20. 2004 NSF NSG panel
21. IEEE Transactions on Parallel and Distributed Computing special issue on Middleware, 2003
22. 2003 NSF ITR panel
23. 2002 NSF CAREER panel
24. IEEE Internet Computing Magazine, 2002
25. NIST Competence Proposals, May 2002
26. DARPA MoBIES program, May 2002
27. DARPA NEST program, May 2002
28. DARPA DASADA program, April 2002
29. Elsevier Journal of Systems and Software Special Issue on Software Architecture: Engineering Quality Attributes, 2002
30. IEEE Communications Magazine, Evolving Communications Software: Techniques and Technologies, 2001
31. DARPA Network Embedded Software Technology (NEST) program, 2001
32. DARPA Software Enabled Control (SEC) program, 2000
33. IEEE Concurrency magazine, Object-Oriented Systems Track, 1999
34. IEEE Journal on Selected Areas in Communications special issue on "Service Enabling Platforms for Networked Multimedia Systems," 1999
35. IEEE Journal of Communications and Networks, 1999
36. Reviewer for the 4^{th} Pattern Languages of Programming Design book published by Addison Wesley
37. The International Journal of Time-Critical Computing Systems, special issue on Real-time Middleware, edited by Wei Zhao
38. Next Generation Internet (NGR) networking research review panel, October 1998
39. IEE Transactions on Software Engineering, special issue on Configurable Distributed Systems
40. Theme issue on Symbolic Modeling in Practice for the Communications of the ACM
41. "Multimedia DBMS and the WWW" Minitrack at the 32nd Hawaii International Conference on System Sciences, 1999
42. "Dependable Distributed Systems" Minitrack at the 32nd Hawaii International Conference on System Sciences, 1999

43. IEEE Computer special issue on "Design Challenges for High-Performance Network Interfaces," 1998
44. 1998 NSF Experimental Software Systems review panel.
45. ACM SIGMetrics Conference, 1998
46. ACM Transactions on Software Engineering Methods
47. Special Issue on Patterns and Pattern Languages for the journal of Theory and Practice of Object Systems, (Stephen P. Berczuk, Editor), John Wiley and Sons, 1995
48. Special Issue of Computer Communications on Building Quality of Service into Distributed Systems
49. IEEE Communications Magazine
50. IEEE/ACM Journal of Transactions on Networking
51. Communications of the ACM
52. IEE/BCS Distributed Systems Engineering Journal
53. Software Practice and Experience, John Wiley and Sons
54. 1998, 1997, and 1996 NSF networking program
55. 1996 NSF software engineering and programming languages CAREER panel
56. 1994 California MICRO (Microelectronics Innovation Computer Research Opportunity) engineering computer network grant review process
57. IEEE Conference on Parallel and Distributed Computing Systems, 1994
58. IEEE International Conference on Computer Communications and Networks, 1994
59. IEEE INFOCOM conference, 1994
60. 1993 NASA Applied Information Systems Research grant review process
61. 1992 California MICRO (Microelectronics Innovation Computer Research Opportunity) engineering computer network grant review process
62. 7^{th} *IFIP International Conference on Upper Layer Protocols, Architectures, and Applications*, 1992
63. The 1992 Special Issue on Measurement for IEEE Journal Transactions on Software Engineering

Memberships: IEEE, ACM, and USENIX

Patents

1. US patent 7,523,471 – "Interpretive network daemon implemented by generic main object," in conjunction with Karlheinz Dorn, Dieter Quehl, Detlef Becker, and Christian Scharf of SIEMENS Medical Engineering, Erlangen, Germany, 2009.

Theses Supervised

- *Doctoral and Masters Committees Chaired*

  1. Chaired the masters thesis committee for Cici Wang, November 2021.
  2. Chaired the masters thesis committee for Evan Segaul, March 2021.
  3. Co-chair of the doctoral dissertation defense for Peng Zhang, August 2018.
  4. Co-chair of the doctoral dissertation defense for James Edmondson, March 2012.
  5. Co-chair of the doctoral topic defense for James Edmondson, December 2011.
  6. Co-chair of the doctoral dissertation defense for Will Otte, November 2011.
  7. Chair of the doctoral dissertation defense for Brian Dougherty, March 2011.
  8. Chair of the doctoral topic defense for Brian Dougherty, June 2010.
  9. Chair of the masters defense for Pooja Varshneya, May 2010.
  10. Chair of the doctoral topic defense for Nilabja Roy, March 2010.
  11. Chair of doctoral topic defense for Joe Hoffert, November 2009.

12. Chair of the doctoral dissertation defense for Jai Balasubramanian, September 2009.
13. Chair of masters defense for Friedhelm Wolf, March 2009.
14. Chair of the doctoral dissertation defense for Nishanth Shankaran, October 2008.
15. Chair of the doctoral dissertation defense for Jules White, October 2008.
16. Chair of doctoral dissertation defense for Gan Deng, December 2007.
17. Chair of doctoral dissertation defense for Krishnakumar Balasubramanian, September 2007.
18. Chair of the doctoral topic defense for Nishanth Shankaran, April 2007.
19. Chair of doctoral topic defense for Krishnakumar Balasubramanian, March 2006.
20. Chair of doctoral topic defense for Gan Deng, March 2006.
21. Chair of final doctoral dissertation defense for Arvind Krishna, December 2005.
22. Chair of masters thesis committee for Emre Turkay, summer 2005.
23. Chair of doctoral topic defense for Arvind Krishna, summer 2005.
24. Chair of masters thesis committee for Ossama Othman, December, 2002.
25. Chair of doctoral dissertation committee for Carlos O'Ryan, May, 2002.
26. Chair of dissertation topic defense committee for Carlos O'Ryan, September, 2001.
27. Chair of masters committee for Nagarajan Surendran, August, 1999.
28. Chair of masters committee for Alexander Babu Arulanthu, July, 1999.
29. Chair of oral exam committee for Chris Gill, June, 1999.
30. Chair of doctoral exam committee for Andy Gokhale, May, 1998.
31. Chair of masters exam committee for Sumedh Mungee, May, 1998.
32. Chair of masters exam committee for Sergio Flores, May, 1998.
33. Chair of masters committee for Prashant Jain, June 1997.
34. Chair of doctoral topic defense for James Hu, February 1997.
35. Chair of masters committee for Tim Harrison, February 1997.
36. Chair of doctoral topic defense committee for Andy Gokhale, October, 1996.

- *Doctoral and Masters Committees Member*

1. Served on the doctoral topic defense for Zhongwei Teng, April 2021.
2. Served on the masters thesis committee for Gabriela Gresenz, March 2021.
3. Served on the masters thesis committee for Xiaoxing Qiu, March 2021.
4. Served on the doctoral dissertation defense for Anirban Bhattacharjee, January 2020.
5. Served on the doctoral topic defense for Anirban Bhattacharjee, April 2019.
6. Served on the doctoral dissertation defense for Shunxing Bao, September 2018.
7. Served on the doctoral dissertation defense for Shashank Shekhar, May 2018.
8. Served on the doctoral dissertation defense for Fangzhou Sun, March 2018.
9. Served on the doctoral topic defense for Shunxing Bao, March 2018.
10. Served on the doctoral topic defense for Peng Zhang, January 2018.
11. Served on the doctoral dissertation defense for Marcelino Rodriguez-Cancio, December 2017.
12. Served on the doctoral dissertation defense for Yao Pan, November 2017.
13. Served on the doctoral topic defense for Fangzhou Sun, September 2017.
14. Served on the doctoral topic defense for Shashank Shekhar, May 2017.
15. Served on the doctoral topic defense for Yao Pan, February 2017.
16. Served on the doctoral dissertation defense for Faruk Caglar, July 2015
17. Served on the doctoral dissertation defense for Wei Yan, May 2015.
18. Served on the doctoral dissertation defense for Kyoungho An, March 2015.
19. Served on the masters thesis committee for Songtao Hei, March 2015.
20. Served on the masters thesis committee for Meng Wang, March 2015.
21. Served on the doctoral dissertation defense for Sean Hayes, January 2015.
22. Served on the doctoral dissertation defense for Hamilton Turner, November 2014.
23. Served on the doctoral topic defense for Faruk Caglar, November 2014.

24. Served on the doctoral topic defense for Hamilton Turner, February 2014.
25. Served on the doctoral dissertation defense for Fan Qui, February 2014.
26. Served on the doctoral dissertation defense for Xiaowei Li, May 2013.
27. Served on the doctoral topic defense for Fan Qiu, April 2013.
28. Served on the doctoral dissertation defense for Janos Mathe, August 2012.
29. Served on the doctoral dissertation defense for Tripti Saxena, July 2012.
30. Served on the doctoral dissertation defense for Akshay Dabholkar, April 2012.
31. Served on the doctoral topic defense for Xiawei Li, March 2012.
32. Served on the doctoral topic defense for Janos Mathe, August 2011.
33. Served on the doctoral dissertation defense for Liang Dai, April 2011.
34. Served on the doctoral dissertation defense for Daniel Balasubramanian, March 2011.
35. Served on the doctoral topic defense for Will Otte, February 2011.
36. Served on the doctoral topic defense for Akshay Dabholkar, February 2011.
37. Served on the doctoral dissertation defense for Joe Hoffert, February 2011.
38. Served on the doctoral topic defense for Tripti Saxena, January 2011.
39. Served on the doctoral dissertatin defense for Nilabja Roy, November 2010
40. Served on the doctoral topic defense for Daniel Balasubramanian, October 2010.
41. Served on the doctoral dissertation defense for Sumant Tambe, September 2010.
42. Served on the doctoral topic defense for Sumant Tambe, April 2010.
43. Served on the doctoral dissertation defense for John Kinnebrew, March 2010.
44. Served on the doctoral dissertation defense for Shanshan Jiang, November 2009.
45. Served on the doctoral dissertation defense for James Hill, March 2009.
46. Served on the doctoral topic defense for James Hill, October 2008.
47. Served on the doctoral topic defense for Jai Balasubramanian, August 2008.
48. Served on the doctoral topic defense for Liang Dai, December 2008.
49. Served on the doctoral topic defense for Shanshan Jiang, November 2008.
50. Served on the doctoral topic defense for Jules White, April 2008.
51. Served on the doctoral topic defense for Amogh Kavimandan, February 2008.
52. Served on the doctoral dissertation defense for Amogh Kavimandan, November 2008.
53. Served on the doctoral topic defense for Amogh Kavimandan, February 2008.
54. Served on the doctoral dissertation defense for Michael Stal, University of Groningen, March 2007.
55. Served on the doctoral topic defense for Karlkim Suwanmongkol, fall 2004.
56. Served on the doctoral dissertation topic defense committee for Aditya Agrawal, July, 2004.
57. Served on the doctoral dissertation defense for Angelo Corsaro, July 2004.
58. Served on the doctoral dissertation defense for Nanbor Wang, April 2004.
59. Served on the doctoral topic defense for Angelo Corsaro, October 2003.
60. Served on the doctoral dissertation defense committee for Jonathan Sprinkle, July, 2003.
61. Served on the doctoral dissertation topic defense committee for Aditya Agrawal, June, 2003.
62. Served on masters committee for Kirk Kelsey, March 2003.
63. Served on the dissertation topic defense committee for Jonathan Sprinkle, February, 2003.
64. Served as external examiner for Bob Jolliffe's masters thesis Department of Computer Science, University of South Africa, March, 2003.
65. Served on the doctoral dissertation committee for Irfan Pyarali, December, 2001.
66. Served on the doctoral dissertation committee for Chris Gill, December, 2001.
67. Served as external examiner for Daniel Heggander's Ph.D. dissertation in the Department of Software Engineering and Computer Science at Blekinge Institute of Technology, Sweden, September, 2001.
68. Served as external examiner for Mohammad Radaideh's masters thesis in the Electrical Engineering department at McMaster's University, Canada, Winter 2000.

69. Served as external examiner for David Holmes' Ph.D. dissertation in the information and computer sciences department at Macquarie University, Sydney, Fall 1999.
70. Served on final doctoral dissertation committee for Priya Narasimhan, August, 1999.
71. Served on the doctoral final dissertation defense for Christo Papadopoulos, August, 1999.
72. Served on dissertation topic defense for Michael Plezbert, February, 1999.
73. Served on masters committee for Craig Nauman, February, 1999.
74. Served on the doctoral exam committee for Chuck Cranor, July, 1998.
75. Served on masters exam committee for Mihai Tutunaru, April, 1998.
76. Served on the doctoral exam committee for Michael Plezbert, June, 1997.
77. Served on masters committee for Todd Rogers, June 1997.
78. Served on masters committee for Robert Engel, January 1997.
79. Served on committee for final doctoral dissertation defense of R. Gopalakrishnan, November, 1996.
80. Served on committee for final doctoral dissertation defense of Lorrie Cranor, September, 1996.
81. Served on the doctoral dissertation topic proposal committee for Christos Papadopoulos July, 1995.
82. Served on the doctoral dissertation topic proposal committee for Charles Cranor December, 1994.
83. Served on oral exam committee for Andy Gokhale December, 1994.
84. Served on the doctoral dissertation proposal committee for Lorrie Cranor, December, 1994.
85. Served on the doctoral final dissertation defense committee for Donald Wilcox, November, 1994.
86. Served on masters committee for Madhavapeddi Shreedhar, September, 1994
87. Served on the doctoral dissertation topic proposal committee for R. Gopalakrishnan, September, 1994.

- *Doctoral Student Advisees and Co-Advisees*

1. Mike Walker (USA)

- *Graduated PhD Students*

1. Jaiganesh Balasubramanian, Ph.D., 2009, currently works for Citigroup, New York, NY.
2. Krishnakumar Balasubramanian, Ph.D., 2007, Mathworks, Boston, MA.
3. Angelo Corsaro, Ph.D. 2004, PrismTechnologies, Parise France.
4. Gan Deng, Ph.D., 2007, Citigroup, Charleston, SC.
5. Brian Dougherty, Ph.D. 2011, Optio Labs, Nashville, TN.
6. James Edmondson, Ph.D., 2012, Member of the Technical Staff, Software Engineering Institute, Pittsburgh, PA.
7. Chris Gill, Ph.D. 2001, Professor, Washington University, St. Louis, MO.
8. Andy Gokhale, Ph.D. 1998, Associate Professor, Vanderbilt University, Nashville, TN.
9. James Hill, Ph.D., 2009, Assistant Professor, Indiana University, Purdue University, Indianapolis.
10. Joe Hoffert, Ph.D. 2011, Assistant Professor, University of Edmonton, Canada.
11. John Kinnebrew, Ph.D., 2010, ISIS, Nashville, TN.
12. Arvind Krishna, Ph.D. 2005, Qualcomm, San Diego, CA.
13. Irfan Pyarali, Ph.D. 2001, CitiGroup, New Jersey.
14. Nilabja Roy, Ph.D. 2011, Research Scientist, Institute for Software Integrated Systems, Nashville, TN.
15. Carlos O'Ryan, Ph.D., 2002, CitiGroup, Charleston, SC.
16. Nishanth Shankaran, Ph.D., 2008, Amazon, Seattle, WA.
17. Nanbor Wang, Ph.D. 2004, Research Scientist, Tech-X, Boulder, Colorado.
18. Jules White, Ph.D. 2008, Assistant Professor, Virginia Tech, Blackburg, VA.

- *Graduated Masters and Ugrad Students*

  1. Alexander Babu Arulanthu, MS 1999, Sylantro, Campbell, CA.
  2. Everett Anderson, BS 1998, Sun, Mountain View, CA.
  3. Shawn Atkins, BS 1998, Lucent, Columbus, OH.
  4. Matt Braun, BS 1998.
  5. Darrell Brunsch, BS 1999, Microsoft, Redmond, WA.
  6. George Edwards, BS 2004, Ph.D. student at University of Southern California.
  7. Sergio Flores-Gaitan, MS 1998, Microsoft, Redmond, WA.
  8. Priyanka Gontla, MS 2000, UBS, Irvine, CA.
  9. Pradeep Gore, MS 2000, OOMWorks, New Jersey.
  10. Tim Harrison, MS 1997, Mayasoft, Palo Alto, CA.
  11. Prashant Jain, MS 1997, IBM Research, India.
  12. Vishal Kachroo, MS 1999, Stentorsoft, CA.
  13. Michael Kircher, BS 1998, Siemens CT, Munich, Germany.
  14. Yamuna Krishnamurthy, MS 2000, OOMWorks, New Jersey.
  15. Tao Lu, MS 2003, Trading Technologies, Chicago, IL.
  16. Sumedh Mungee, MS 1998, Fujitsu, Santa Clara, CA.
  17. Bala Natarajan, MS 2000, Veritas, India.
  18. Kirthika Parameswaran, MS 2000, Telcordia, Piscataway, NJ.
  19. Stoyan Paunov, MS 2006, working at Bloomberg, NYC.
  20. Ossama Othman, MS 2002, independent consultant, Portland, OR.
  21. Marina Spivak, MS 2000, AT Desk, Charleston, SC.
  22. Nagarajan Surendran, MS 1999, Sylantro, Campbell, CA.
  23. Emre Turkay, MS 2005, Turkey.
  24. Pooja Varshneya, May 2010, Zircon Computing, Wayne, NJ.
  25. Seth Widoff, BS 1998, independent consultant, San Francisco, CA.
  26. Ming Xiong, MS 2007, currently working at AT Desk, Charleston, SC.

- *Former Staff*

  1. Chris Cleeland, OCI, St. Louis, MO.
  2. Ray Klefstad, Research Assistant Professor, University of California, Irvine.
  3. Boris Kolpackov, Independent Consultant, South Africa.
  4. Fred Kuhns, Research Associate, Washington University, St. Louis, MO.
  5. David Levine, Director of Engineering, CombineNet, Inc, Pittsburgh, PA.
  6. Will Otte, Institute for Software Integrated Systems, Nashville, TN
  7. Jeff Parsons, Optio Labs, Nashville, TN
  8. Jules White, Ph.D. 2008, Vanderbilt University, Nashville, TN

Research Support

Total research funding since June 1995: $41,899,342

- Sole PI: $12,030,403
- Co-PI: $29,868,939

Grants and Contracts Received

1. "Automated Clothing Simulation and Human Avatar Generation Engine" NSF, 9/15/2019 to 2/29/2020, $50,000.

2. "Digital Thread Modelling Environment (DTME)," AFRL (subcontract through Securboration), 8/20/2019 to 8/20/2021, $250,000, with Jules White.
3. "Creating an Evidence-based Professional Development Support Tool for Pre-K Coaches and Teachers," Department of Education (IES), $1,399,992, 7/1/18 to 6/30/22, Co-PI with Caroline Christopher.
4. "Blockchain as Middleware Services for Transactive Energy Applications," Siemens, 4/1/2017 to 9/30/2018, $274,397, co-PI Abhishek Dubey.
5. "Children Eating Well (CHEW) Smartphone Application for WIC Families," USDA 4/15/2017 to 4/14/2022, , co-PI with Pam Hull.
6. "Industrial Internet Architecture," Varian Medical Systems, Inc., 10/1/14 to 12/31/18, $288,808, co-PI Jules White.
7. Securboration, "Virtualize Combat System Environment (ViCE)," $15,000, 1/1/18-3/26/18, Co-PI with Jules White.
8. "Container Hopping at Random Intervals or Targeted-Attacked (CHARIOT)," OSD SBIR with Securboration, 1/19/17 to 1/19/18, $35,000.
9. "A Digital Platform for Social and Emotional Learning," NSF, 7/1/2018 to 12/31/2018, $50,000.
10. "Blockchains Data Exchange via FHIR," Solaster, 9/1/18 to 8/31/19, $30,000, co-PI with Jules White.
11. "Advancing Data-Driven mHealth Technologies for Long-term Health and Health Behavior Change," Trans-Institutional Program (TIPs), Vanderbilt University, 9/1/2016 to 8/31/2018, $100,000, Co-PIs Jules White, Trent Rosenbloom, and Heidi Silver.
12. "IMMoRTALS," DARPA (through subcontract with Raytheon), 12/1/15 to 12/1/19, $1,235,567, Co-PI Jules White.
13. "The Robust Software Modeling Tool (RSMT)," ONR, 7/1/14 to 6/30/17, $749,904, Co-PI Jules White.
14. "Building Resilient Distributed Systems for Next Generation Mobile Adhoc Cyber Physical Systems," Siemens 9/1/14 to 8/31/17, $438,188, co-PI Abhishek Dubey.
15. "Capability-Based Technical Reference Frameworks for Open System Architecture Implementations," OSD ASDR&E, 7/3/14 to 9/11/14, $29,690.
16. "Progressive Model Generation for Adaptive Resilient System Software," ONR STTR, 8/6/13 to 1/31/14, $49,406, co-PI Jules White.
17. "Systems and Software PRodUcibility Collaboration and Experimentation Environment (S2PRUCE2)," AFRL (subcontract through Lockheed Martin Advanced Technology Lab), 1/4/13 to 9/30/13, $108,645, with A. Gokhale.
18. "Stochastic Hybrid Systems Modeling and Middleware-enabled DDDAS for Next-generation US Air Force Systems," AFOSR, 10/1/13 to 9/30/16, $935,402, Co-PI(s) Aniruddha Gokhale and Xenofon Koutsoukous.
19. "Workshop on Computing Clouds for Cyber Physical Systems," NSF, 9/15/12 to 12/31/2013, $73,738.
20. "Using Social Learning to Improve Adolescent Diabetes Protocol Adherence," NIH, $1,798,029, 9/1/12-8/31/16, PI Shelagh Mulvaney.
21. "Systems and Software PRodUcibility Collaboration and Experimentation Environment (S2PRUCE2)," AFRL (subcontract through Lockheed Martin Advanced Technology Lab), 4/3/08 to 9/30/12, $381,708, with A. Gokhale.
22. "Team for Research in Ubiquitous Secure Technology (TRUST)," NSF (subcontract through UC Berkeley), 6/1/05 to 10/31/15, $5,970,900, co-PI(s) J. Sztipanovits and G. Karsai.
23. "Android Mobile Military Middleware Objects (AMMO)," DARPA, 9/30/10 to 5/02/12, $1,074,093, with S. Neema.
24. "Cyber-physical multi-Core Optimization for Resource and cachE effectS (C2ORES)", AFRL, 8/1/12 to 7/31/13, $300,000, with A. Gokhale.

25. "Model-Driven Tools for Distributed- and Multi-Core Middleware," AFRL, 4/10/12 to 10/2/12, $30,000, with A. Gokhale.
26. "Cloud Environmental Analysis and Relief," NSF, 8/1/10 to 7/31/12, $66,000, with A. Gokhale.
27. "Environment-Specific Inter-ORB Protocols," SAIC, 8/1/09 to 5/23/12, $348,350, with A. Gokhale.
28. "CoSMIC and CIAO Enhancements," Northrop Grumman, 7/1/09 to 9/30/10, $878,661
29. "Integrating DDS and CCM," Northrop Grumman, 7/1/09 to 2/15/10, $85,000
30. "Early Integration and Performance Testing of Heterogeneous Computing Environments," Australian Defence Science and Technology Organization (DSTO), 1/9/09 to 7/30/09, $180,000.
31. "Predictive Cache Modeling and Analysis," AFRL (subcontract through Lockheed Martin Aeronautics), 3/1/10 to 9/30/11, $100,000.
32. "Applications of Reliable, Fast Event Notification," Raytheon, 6/1/2008 to 5/30/2009, $60,000.
33. "Open Modular Embedded Architectures," General Electric Global Research, 8/1/2008 to 1/31/2009, $35,000.
34. "Analysis and Simulation Techniques for Next-generation Motion Control Systems," Aagard, 8/1/2008 to 1/31/2009, $13,850 with Akos Ledeczi.
35. "Open Modular Embedded Architectures," Raytheon, 8/1/2008 to 3/31/2009, $74,276.
36. "NAOMI," LMCO Advanced Technology Lab, 9/1/2007 to 11/30/2009, $290,000.
37. "IU/CRC Membership," Siemens, 1/1/2009 to 12/31/2009, $40,000.
38. "Enterprise Application Configuration in the Context of Model Driven Software Development and Software Factories," Siemens Corporate Research, 10/1/07 to 9/31/08 $91,798.
39. "Modular Extendable Demonstration of an Upgradeable Space Architecture (MEDUSA)," DARPA (subcontract through Lockheed Martin Advanced Technology Center), 2/1/2008 to 1/31/2011, $600,000.
40. "CCM Middleware Implementation and Integration," PrismTech, 6/8/2007 to 3/31/2007, $33,778.
41. "The Smart Sensor Web Architecture," NASA (subcontract through Lockheed Martin Advanced Technology Center), 12/15/06 to 11/14/09, $467,728, co-PI G. Biswas.
42. "I/UCRC Membership," General motors, 1/1/2008 to 12/31/2008, $100,000, co-PI G. Karsai.
43. "Pollux: Enhanding the Real-time QoS of the Global Information Grid," AFRL, 2/24/06 to 7/24/08, $1,242,718, co-PI M. Reiter.
44. "Intelligent Middleware for Next Generation Petascale Scientific Computing," Vanderbilt Discover Grant, 5/1/05 to 6/30/07, $100,000, co-PI(s) A. Gokhale and P. Sheldon.
45. "Air Force Center for Research on GIG/NCES Challenges," AFOSR (subcontract through UC Berkeley), 3/1/06 to 2/28/08, $600,000, co-PI J. Sztipanovits.
46. "Quality of Service Enabled Dissemination," AFRL (subcontract through BBN Technologies), 12/31/2007 to 9/30/2009, $320,000.
47. "A Fault-Tolerant Real-Time CORBA Naming Service," US Navy (subcontract through Tech-X Corp), 11/1/2007 to 4/30/2010, $175,000, co-PI A. Gokhale.
48. "System Execution Modeling Technologies for Large-scale Net-centric Systems," AFRL, 1/1/2008 to 12/31/2010, $244,000.
49. "Model-Driven Computing for Distributed Real-time Embedded Systems," Raytheon, 8/31/04 to 8/31/08, $500,000.
50. "NAOMI," LMCO Advanced Technology Lab, 9/1/2007 to 11/30/2007, $50,000.
51. "ACE/TAO Improvement Techniques and Solutions, Veritas/Symantec, 3/31/05 to 4/31/08, $198,500.
52. "Adaptive Resource Control for Certificable Systems," DARPA (subcontract through LMCO Advanced Technology Lab), 3/30/2007 to 12/31/2007, $50,000.
53. "Survivable Internet-scale Distributed Systems," IDA, 3/30/2007 to 12/31/2007, $60,000.
54. "QUality of service pICKER (QUICKER)," LMCO Advanced Technology Lab, 3/30/2007 to 12/31/2007, $60,000.

55. "Thimble," LMCO Advanced Technology Lab, 3/30/2007 to 12/31/2007, $60,000.
56. "CADynCE Experimentation Operations (CEO)," DARPA (subcontract through LMCO Advanced Technology Lab), 8/31/2007 to 12/31/2007, $25,000.
57. "Real-time Discovery for Pub/Sub Middleware in WANs," US Navy (subcontract through Tech-X Corp), 6/16/2007 to 9/31/2007, $15,000.
58. "GEMS Utilization Test Suite," LMCO Advanced Technology Lab, 9/1/07 to 11/30/07, $50,000.
59. "Advanced Information Systems and Technology Program," NASA (subcontract through LMCO Advanced Technology Center), 11/13/2007 to 12/1/2007, $22,000, co-PI G. Biswas.
60. "Design for Adaptivity and Reliable Operation of Software Intensive Systems," NSF CNS-0613971, 9/1/06 to 8/31/08, $199,867, co-PI(s) S. Abdelwahed and G. Karsai.
61. "Software Technologies Targeting Interoperability for Systems of Systems," Army Research Lab, 1/15/07 1/14/10, $851,567, co-PI(s) G. Karsai and J. Sztpanovits.
62. "Software Wind Tunnel (SWiT) Capabilities," Lockheed Martin Advanced Technology Lab, 8/1/06 to 12/31/06, $60,000.
63. "High-Confidence Software Platforms for Cyber-Physical Systems," NSF, 5/1/06 to 7/30/08, $129,179.
64. "Applying AOP to Develop of Component Synthesis with MDD," Siemens, 3/1/03 to 2/28/07, $400,005.
65. "Addressing Domain Evolution Challenges in Model-Driven Software Product-lines," Siemens Corporate Research, 10/1/05 9/31/07, $100,000.
66. "A Fault Tolerant Real-time CORBA Naming Service," US Navy (subcontract through Tech-X Corp), 11/1/05 to 8/31/06, $15,000.
67. "The SYstem DEployment and Configuration AssisteR (SYDECAR)," Lockheed Martin Advanced Technology Lab, 8/1/05 to 8/1/08, $500,000.
68. "Future Combat Systems: Software Architecture Engineering," DARPA (subcontract through Boeing), 1/28/05 to 12/31/07, $2,764,226, co-PI(s) J. Sztipanovits and G. Karsai.
69. "Development of an Eclipse Plug-in," PrismTech, 4/28/05 to 9/30/05, $25,000.
70. "Prometheus: Enhancing the QoS of the JBI," AFRL, 3/25/05 to 12/31/05, $500,000, co-PI(s) K. Birman and Mike Reiter.
71. "A Testbed for Assuring Quality of Software for DRE Systems," ONR, 2/15/05 to 1/31/06, $200,000, co-PI(s) A. Gokhale and A. Porter.
72. "Enhancing the QoS of SOAs Using Eclipse-based MDD," IBM, 2/15/05 to 1/31/06, $29,515, co-PI A. Gokhale.
73. "Model-Driven Development of BEEP Application Protocols," Cisco, 12/15/04 to 12/14/05, $57,976, co-PI A. Gokhale.
74. "Evaluating CORBA Middleware for Space Systems," NASA (subcontract through Lockheed Martin Advanced Technology Center), 9/23/04 to 11/30/06, $186,180, co-PI G. Biswas.
75. "Refactoring Techniques to Reduce Middleware Resource Utilization," Qualcomm, 10/31/04 to 10/31/05, $104,000, co-P B. Natarajan.
76. "Model-Driven Development for Software Defined Radios," BAE Systems, 12/1/04 to 3/31/05, $32,000.
77. "Enhancing the Robustness and Performance of TENA," DISA (subcontract through SAIC and OSC), 7/1/04 to 12/31/04, $75,000.
78. "QoS-enabled Fault Tolerant Middleware and MDA Tools," Lockheed Martin MSS, 4/1/03 to 12/31/04, $516,434.
79. "Trustworthiness in Embedded Systems," NSF ITR CCR-032574, 9/31/03 to 8/31/06, $210,454.
80. "ACE+TAO Enhancements," OCI, gift $20,000.
81. "Acquiring Accurate Dynamic Field Data Using Lightweight Instrumentation," NSF ITR CCR-0312859, 10/1/02 to 9/31/07, $1,850,000, co-PI(s) A. Porter, D. Notkin, and A. Karr.
82. "Intergovernmental Personnel Act," DARPA, 6/1/00 to 5/31/02, $198,934.

83. "Optimizing Component Models," DARPA, 4/1/01 to 6/31/02, $210,000.
84. "HLA RTI Next-generation," DMSO (subcontract through SAIC), 6/1/01 to 12/31/01, $70,895.
85. "ACE Enhancements for Windows NT and Windows CE," Siemens Medical Engineering, 2/1/00 9/19/01, $112,000.
86. "Scalable and Fault Tolerant Middleware," AFRL MURI, 12/1/99 to 3/31/02, $253,701.
87. "Protocol Engineering Research Center," AFOSR MURI, 6/15/00 to 6/14/03, $264,720, co-PI Tatsuya Suda.
88. "Optimizing ORBs for Network Management," Cisco Systems, 1/1/00 to 12/31/00, $100,000.
89. "TAO Optimizations," Raytheon, 10/1/99 to 6/01/01, $50,000.
90. "ACE+TAO on pSoS," Motorola, 8/15/99 to 12/31/99, $30,000.
91. "Real-time Distributed Object Computing," Sprint, 8/15/99 8/14/00, $133,068.
92. "TAO Enhancements," Krones, 8/1/99 to 9/1/99, $5,000.
93. "ACE Enhancements," ICOMVERSE, gift, $20,000.
94. "Weapon Systems Open Architecture," Boeing, 7/15/99 to 1/31/00, $51,491.
95. "Fault Tolerant CORBA," Motorola Labs, 7/15/99 to 7/14/00, $139,000.
96. "TAO Enhancements," Global MAINTECH, 7/1/99 to 8/1/99, $5,000.
97. "ACE QoS Extensions," Motorola Trunking, 6/1/99 to 8/1/99, $5,000.
98. "CORBA Interceptors," Experian, 5/15/99 7/14/99, $10,000.
99. "DCOM performance evaluation," Microsoft, gift, $30,000.
100. "TAO Improvements," OCI, 4/1/99 to 9/31/00, $27,000.
101. "Middleware Optimizations," Telcordia, 2/1/99 to 1/31/00, $52,700.
102. "Minimum CORBA," Hughes Data Networking, 4/1/99 to 3/31/00, $50,000, co-PI David Levine.
103. "Framework Usage Patterns," Siemens Corporate Research, 4/1/99 to 3/31/00, $35,000.
104. "Dynamic Scheduling and Real-time ORB Optimizations," Boeing, 10/1/98 9/30/99, $184,860.
105. "Distributed Object Computing Middleware," Nortel, 11/1/98 10/31/99, $75,000.
106. "ACE subsetting," "ACE subsetting,," Nokia, 10/8/98 4/8/99, $30,000.
107. "Boeing Research Fellowship," Boeing, 9/1/98 8/31/00, $81,486.
108. "Patterns and Frameworks Reuse Curriculum," Lucent Bell Labs, 9/1/98 12/31/98, $31,200.
109. "Patterns, Frameworks, and Components," Siemens ZT, 12/1/98 5/31/00, $175,000.
110. "High availability frameworks," Lucent, 9/1/98 8/31/99, $39,400.
111. "Real-time Distributed Object Computing," Sprint, 8/1/98 7/31/99, $288,194.
112. "Distributed Object Integration for the Quorum Project," DARPA S30602-98-C-0187 (subcontract through BBN), 9/1/98 8/31/01, $448,643, co-PI(s) R. Schantz and J. Loyall.
113. "Evaluating a Framework for Dynamic Distributed Real-Time Scheduling,," USENIX, gift, $18,000.
114. "Distributed Object Computing," Microsoft, gift, $20,000.
115. "Distributed Object Visualization Environment," Lockheed Martin, 5/1/98 to 11/31/99, $54,000.
116. "Distributed Object Computing with Adaptive End-to-end QoS Guarantees," DARPA 9701561, 8/1/97 to 7/31/00, $873,625.
117. "Real-time CORBA for Telecommunications," Lucent, 12/1/97 to 11/31/98, $100,000.
118. "Developing an HLA-compliant RTI with ACE," SAIC, 12/15/97 to 1/31/00, $228,075.
119. "Real-time CORBA for Wireless," Motorola LMPS, 10/15/97 to 10/14/98, $200,000.
120. "Real-time CORBA for Avionics," Computing Devices International, 10/15/97 to 10/14/98, $39,050.
121. "Dynamic Scheduling of Real-time OFPs," Boeing, 9/1/97 to 8/31/98, $224,604.
122. "Distributed Object Visualization," Siemens MED, 10/1/97 to 9/1/98, $40,000.
123. "The ADAPTIVE Communication Environment," Siemens MED, 10/1/97 to 9/1/98, $70,000.

124. "The Architect's Assistant," Siemens Corporate Research, 9/1/97 to 8/1/98, $35,000.
125. "Monitoring, Visualization, and Control of High Speed Networks," NSF NCR-97-14698, 9/1/97 to 8/31/01, $1,200,000, co-PI(s) G. Parulkar, E. Kraemer, J. Turner, and R. Cytron .
126. "Adaptive Software Technology Demonstration (ASTD)," AFRL (subcontract through Boeing), 9/1/98 to 8/31/02, $1,200,000, co-PI(s) B. Doerr, D. Allen, and R. Jha.
127. "Patterns, Frameworks, and Components for Multimedia Systems," Siemens Research, 1/97 to 6/98, $150,000.
128. "Adaptive Servers for High-Performance Imaging," Kodak Networked Imaging Tech. Center, 11/96 to 11/97, $40,000.
129. "Real-time CORBA," Sprint, 9/96 to 12/97, $345,000, co-PI G. Parulkar.
130. "OpenMAP – Object-Oriented Components for Real-time Avionics," McDonnell Douglas, 9/96 to 9/97, $241,591.
131. "Compilation and Automatic Optimization of Network Protocol Implementations," NSF NCR-9628218, 8/96 to 8/99, $411,025, co-PI(s) G. Varghese and R. Cytron (PI).
132. "Medical Imaging with Java and the WWW," SIEMENS Medical Engineering, 8/96 to 7/97, $125,000.
133. "The ADAPTIVE Communication Environment," SIEMENS Medical Engineering, 8/96 to 7/97, $90,000.
134. "High-performance Distributed Medical Imaging," Kodak Imaging, 12/94 to 8/96, $55,152, co-PI J. Blaine.
135. "Design Patterns for Concurrent Object-Oriented Networking," Object Technologies International, 4/96 to 4/97, $25,000.
136. "Distributed Object Computing with CORBA and DCE," Bellcore, 5/96 to 12/96, $32,978.
137. "The ADAPTIVE Communication Environment," SIEMENS Medical Engineering, 6/95 to 6/96, $170,000.

Courses Taught

Courses at Vanderbilt University

1. CS 215 – Intermediate Software Design, Spring 2006
2. CS 251 – Intermediate Software Design, Spring 2007, Spring 2008, Spring 2009, Fall 2009, Spring 2010, Spring 2012, Spring 2013, Spring 2014, Spring 2015, Spring 2016, Summer 2020, Summer 2021
3. CS 253 – Parallel Functional Programming with Java and Android, Fall 2020, Fall 2021
4. CS 254 – Concurrent Object-Oriented Programming with Java and Android Spring 2021
5. CS 291/242 – Software Design Studio, Fall 2004
6. CS 291/242 – Software Design Studio, Fall 2003
7. CS 292 – Beyond the Oneway Web, Fall 2008
8. CS 278 – Software Engineering, Fall 2008
9. CS 279 – Software Engineering Projects, Spring 2010
10. CS 282 – Principles of Operating Systems II, Spring 2003, Spring 2004, Fall 2005, Fall 2007, Fall 2012, Fall 2013, Fall 2014, Fall 2015, Fall 2016, Spring 2017
11. UNIV 278 – Tackling Big Questions with Mobile Cloud Computing, Fall 2016, Spring 2017, Fall 2017
12. CS 395 – Advanced Network Software Design, Fall 2006
13. CS 395 – QoS-enabled Middleware, Fall 2008
14. CS 395 – Reactive Microservices, Summer 2021
15. CS 396 – QoS-enabled Component Middleware, Spring 2005
16. CS 891 – Introduction to Concurrent and Parallel Java Programming with Android, Fall 2017

17. CS 891 – Advanced Concurrent Java Programming in Android, Spring 2018, Spring 2019, Spring 2020
18. CS 891 – Introduction to Parallel Java Programming, Fall 2018, Fall 2019
19. CS 892 – Concurrent Java Programming in Android, Spring 2017

Courses at Coursera

1. Android App Development (Android for Java; Android App Components - Intents, Activities, and Broadcast Receivers; Android App Components - Services, Local IPC, and Content Providers), 2016 to present
2. Mobile Cloud Computing with Android (Pattern-Oriented Software Architecture: Communication; Pattern-Oriented Software Architecture: Concurrency), 2014 to 2016
3. Pattern-Oriented Software Architectures for Concurrent and Networked Software, 2013

Courses at University of California, Irvine

1. ECE 011 – Computational Methods in ECE, Winter 2000
2. ECE 255 – Distributed Software Architecture Design, Spring 2000
3. ICS 142 – Compiler Theory, Summer 1989
4. ICS 23 – Data Structures, Summer 1988

Courses at Washington University, St. Louis

1. CS 562 – Advanced Object-Oriented Software Development with Patterns and Frameworks, Spring 1999
2. CS 242 – Introduction to Software Design, Spring 1998
3. CS 673 – Distributed Systems research seminar, Fall 1997
4. CS 422 – Operating Systems Organization, Fall 1997
5. CS 242 – Introduction to Software Design, Spring 1997
6. CS 544 – Distributed System Design, Fall 1996
7. Ada tasking course for McDonnell Douglas, Fall 1996
8. OO design course for McDonnell Douglas, Spring 1996
9. CS 523 – Distributed Operating Systems Organization, Spring 1995
10. CS 242 – Introduction to Software Design, Fall 1995
11. CS 673 – Distributed Systems research seminar, Spring 1995
12. CS 422 – Operating Systems Organization, Fall 1994

Other Teaching Experience

In addition to the academic teaching experience above, I have also taught numerous short-courses and tutorials on object-oriented design patterns and programming techniques, UNIX and Windows NT systems programming and network programming, C++ and C programming languages, and various distributed/networked system, compiler construction, algorithm, data structure, mobile app, and web-based cloud computing courses for the following universities and professional organizations:

- O'Reilly Live-Training
- Pearson LiveLessons
- University Extension Program, University of California, Berkeley, CA
- University Extension Program, University of California, Irvine, CA
- University Extension Program, University of California, Los Angeles, CA
- Oregon Graduate Institute of Science and Technology, Beaverton, OR
- USENIX association
- Association of Computing Machinery (ACM)
- Addison-Wesley's Technology Exchange Program, Reading, MA
- SIGS Conferences
- Object Computing Institute, St. Louis, MO
- National University, Irvine, CA

Department/School/Community Service

Service at Vanderbilt University

1. Faculty advisor for the "DataBrains" AI and Data Science student club.
2. Faculty advisor for the "Vandy Apps" student club.
3. Faculty advisor for the "BizTech" student club.
4. Led the effort to create an online Professional Masters in CS
5. Led the effort to create a continuing education program in Web Development
6. Interview panel for the Director of Professional Programs in VUSE
7. Served on the Digital Literacy committee
8. Chair of two year review committee for Taylor Johnson
9. Chair of the CS search committee in 2003, 2005, 2013, 2016, 2018
10. Chair of the committee on Big Data for the VUSE Strategic Plan
11. Member of the Provost's Special Task Force of the Data Science Visions Working Group: Trans-institutional Masters in Data Science.
12. Member of the Provost's Data Science Visions working group
13. VUSE representative for the Research IT committee
14. VUSE representative on the Provost's Digital Literacy committee
15. Reviewer for University Course proposals
16. Faculty mentor for "Accenture Garage Program"
17. VUSE representative for the Research IT committee.
18. Member of the search committee for the first Director of the Innovation Center
19. Member of the Provost's Study Group on Cross College Teaching
20. Member of the Advisory Committee for the Vanderbilt Institute for Digital Learning (VIDL)
21. Chair of the Provost's Committee on the Innovation Center
22. Member of the VUSE Career Committee
23. VUSE point of contact for VUIT
24. Committee member for Eugene Vorobeychik's promotion case to associate professor
25. Committee member for Bobby Bodenheimer's promotion case to full professor
26. Committee member for Julie Adams's promotion case to full professor
27. Committee member for Akos Ledeczi's promotion case to full professor
28. Chair of the tenure committee for Yuan Xue
29. Chair of the four year review committee for Yuan Xue
30. Member of the two year committee for Yuan Xue
31. Member of the promotion committee for Ted Bapty
32. Member of review committee for Xenofon Koutsoukos
33. Chair of promotion committee for Gabor Karsai
34. Member of promotion committee for Gautam Biswas
35. Chair of the VUSE Technology Entrepreneurship Task Force
36. Member of the VUIT faculty advisory committee
37. Owen-VUSE joint committee for 2014-2015
38. Chair of the Schmidt Family Annual Educational Technologies Lectureship
39. Member of the Provost's Study Group on Cross College Teaching
40. Chair of two year review committee for Eugene Vorobeychik

41. Member of the Chancellor's Social Media and the Internet committee
42. Member of the VU Online Education Task Force
43. Member of the ad hoc committee on EECS Industrial Advisory Board
44. Ex-officio member of the ad hoc committee on the CS graduate program
45. Ex-officio member of the ad hoc committee on the CS undergraduate program
46. Faculty facilitator for the Vanderbilt Visions program
47. Chair of the Information Technology committee for the Vanderbilt School of Engineering
48. Chair of the tenure committee for Bobby Bodenheimer
49. EECS Corporate/Internship Liaison for Computer Science and Engineering
50. Ex-officio Member of the Ad Hoc Committee on Computer Engineering
51. Faculty sponsor of the new EECS Graduate Student Organization
52. Member of the VUSE Research Institutes and Centers Council
53. Associate Chair of Computer Science and Engineering
54. Member of the Vanderbilt University Faculty Senate
55. Chair of the faculty committee on Academic Computing and Information Technology (ACIT)
56. Member of the Research Advisory Committee on Information Technology (RACIT)
57. Chair of the Systems Engineering concentration committee
58. Member of the Plan Integration and Communication Group (PICG)
59. Member of the CS graduate curriculum committee

Service at Washington University, St. Louis

1. Member of the Faculty recruiting committee
2. Member of the CS committee on recruiting industrial graduate students (RIGS)
3. Member of the CS Experimental Infrastructure for Teaching and Research (CEITR)
4. Member of the Introductory course committee
5. Member of the Graduate admission committee
6. Member of the CS representative to the CEC advisory board
7. Member of CS departmental chair search committee

Awards and Honors

1. Received the Cornelius Vanderbilt Professor of Engineering endowed chair in February 2017.
2. Received the 2015 Award for Excellence in Teaching by the Vanderbilt University School of Engineering.
3. Interviewed for Software Engineering Radio (www.se-radio.net/).
4. Vice-chair of the IEEE Chapter in middle Tennessee.
5. Elected to three year term as member of the Vanderbilt University Faculty Senate.
6. Invited speaker at the dedication of the Henry Samueli School of Engineering, along with UC Irvine Chancellor, Ralph Cicerone; Dean of the School of Engineering, Nicolaos Alexopoulos; Chairperson of the Regents of the University of California, S. Sue Johnson; President of the University of California, Dick Atkinson; and CTO and co-founder of Broadcom Henry Samueli.
7. Interviewed for Dr. Dobb's journal TechNetCast, October 24, 2000.
8. Interviewed for **iX** magazine, October, 2000.
9. Received early promotion to tenure as an Associated Professor at Washington University, St. Louis, five years after joining the faculty as an Assistant Professor in 1994.

10. Director of the "Center for Distributed Object Computing" at Washington University, St. Louis since spring of 1999.
11. Listed in Marquis' "Who's Who in Media and Communications," 1997.
12. Received joint appointment to the Mallinckrodt Institute Department of Radiology, Washington University School of Medicine, February 1996.
13. Selected to participate in the ACM OOPSLA '94 Doctoral Symposium.
14. Invited by Dr. Martina Zitterbart to participate in a 4-week international exchange program at the Universität Karlsruhe Institut für Telematik in Karlsruhe, Germany, April 1993.
15. Served as elected representative to the Associated Graduate Student organization at the University of California, Irvine from May 1991 to June 1992.
16. Served as elected graduate student representative to the Computer Science Computing Resource Committee at the University of California, Irvine from August 1988 to August 1990.

Consulting Work

1. ARINC, Fountain Valley, CA
2. ACM, NY, NY
3. Advanced Institute of Information Technology, Seoul, Korea
4. AG Communication Systems, Phoenix, AZ
5. Anderson Consulting, Chicago, IL
6. Apple, Cupertino, CA
7. AT&T Research, Murray Hill, NJ
8. BAE Systems, Greenlawn, NY
9. BAE Systems, Wayne, NJ
10. BEA, San Jose, CA
11. Bellcore, Morristown, NJ
12. BellSouth, Atlanta, GA
13. Boeing, St. Louis, MO
14. Boies, Schiller, & Flexner, Santa Monica, CA
15. Bridges & Mavrakakis, Palo Alto, CA
16. Cooley LLP, San Francisco, CA
17. Correct Care Solutions, Nashville, TN
18. Credit Suisse, Zurich, Switzerland
19. Crosskeys, Ottawa, Canada
20. DARPA, Arlington, VA
21. Desmarais, NY, NY
22. Duane Morris, Atlanta, GA
23. Edward D. Jones, St. Louis, MO
24. Envision Inc. St. Louis, MO
25. Ericsson, Cypress, CA
26. Fitzpatrick, Cella, Harper & Scinto, NY, NY
27. GaN Corporation, Huntsville, AL
28. Gibson, Dunn, & Crutcher, NY, NY
29. Goldman, Ismail, Tomaselli, Brennan, & Baum, Chicago, IL
30. Jet Propulsion Lab, Pasadena, CA

31. Kasowitz, Benson, & Torres, Redwood Shores, CA
32. Keystone Strategy, Boston, MA
33. Kilpatrick Stockton, Atlanta, GA
34. Kirkland & Ellis, San Francisco, CA
35. Kodak Imaging, Rochester, NY
36. Laureate University, Baltimore, MD
37. Lockheed Martin Tactical Systems, Minneapolis, MN
38. Lockheed Martin Mission Systems, Boulder, CO
39. Lockheed Martin Advanced Technology Lab, Cherry Hill, NJ
40. Lucent Bell Labs, Naperville, IL
41. Lucent Bell Labs, Murray Hill, NJ
42. Lucent, Whippany, NJ
43. McDonnell Douglas, St. Louis, MO
44. Microsoft, Redmond, WA
45. Morrison & Foerster, Washington DC
46. Morgan Stanley, New York, NY
47. Motorola Cellular Infrastructure Group, Arlington Heights, IL
48. Motorola Iridium, Chandler, AZ
49. Motorola Land Mobile Products, Chicago, IL
50. National Security Agency, Ft. Meade, MD
51. Naval Air Weapons Stations, China Lake, CA
52. Nortel, Ottawa, Canada
53. Object Computing Institute, St. Louis, MO
54. Object Technologies International, Ottawa, CA
55. Odetics Broadcasting, Anaheim, CA
56. Oracle, Redwood Shores, CA
57. Park, Vaughan, & Fleming, Boise, ID
58. Pearson Education, London, UK
59. Pragmatus, Alexandria VA
60. PrismTechnologies, Newcastle, UK
61. Qualcomm, San Diego, CA
62. Quinn Emanuel, NY, NY
63. Raytheon, San Diego, CA
64. Reichman Jorgensen, CA
65. Riverace, Boston, MA
66. Rubin Anders Scientific, Boston, MA
67. SAIC, Washington D.C.
68. Schwegman, Lundbert, & Woessner, Minneapolis, MN
69. Siemens Medical Engineering, Erlangen, Germany
70. Siemens Corporate Research, Princeton, NJ
71. SIGS, New York, NY
72. Software Engineering Institute, Pittsburgh, PA
73. Teradyne, Chicago, IL
74. Teledyne, Thousand Oaks, CA

75. UC Berkeley Extension, Palo Alto, CA
76. UCLA Extension, Los Angeles, CA
77. USENIX, Lake Forest, CA
78. Venable, NY, NY
79. Wong, Cabello, Lutsch, Rutherford & Brucculeri, Houston, TX
80. WMS Gaming, Chicago, IL
81. Zircon Computing, Wayne, NJ

Expert Testimony in the Past Five Years

1. March 2016, Deposed in support of Oracle in the Oracle vs. Google Fair Use trial in the United States District Court for the Northern District of California, San Francisco division. Case No. Civ. A. No. 10-03561 WHA.
2. May 2016, Testified in support of Oracle in the Oracle vs. Google Fair Use trial in the United States District Court for the Northern District of California, San Francisco division. Case No. Civ. A. No. 10-03561 WHA.
3. February 2017, Deposed in support of IBM in the IBM vs. Priceline Group case. Case No. Civ. A. N. 15-cv-137-LPS-CJB.
4. February 2018, Deposed in support of IBM in the IBM vs. Groupon case. Case No. Civ A. N. 16-122-LPS-CJB.
5. July 2018, Testified in support of IBM in the IBM vs. Groupon case. Case No. Civ A. N. 16-122-LPS-CJB.
6. August 2018, Deposed in support of Palo Alto Networks in the Palo Alto Networks vs. Implicit case. Case No. Civ 6:17-CV-182-JRG.
7. January 2019, Deposed in support of C3IoT in the E2.0 vs. C3IoT case. Case No. 1:15-cv-00530-GMS.
8. February 2019, Testified in support of C3IoT in the E2.0 vs. C3IoT case. Case No. 1:15-cv-00530-GMS.
9. June 2019, Deposed in support of IBM in the IBM vs. Expedia Inc. case. Civil Action No. IPR2018-01136.
10. July 2019, Deposed in support of Philips in the Philips vs. Microsoft case. Civil Action No. 4:18-cv-01885-HSG.
11. August 2019, Deposed in support of Philips in the Philips vs. HTC case. Civil Action No. 4:18-cv-01885-HSG.
12. August 2019, Deposed in support of Philips in the Philips vs. ASUS case. Civil Action No. 4:18-cv-01885-HSG.
13. September 2019, Deposed in support of Kroy in the Kroy vs. Groupon case. Civil Action No. IPR2019-00044.
14. September 2019, Deposed in support of Kroy in the Kroy vs. Groupon case. Civil Action No. IPR2019-00061.
15. March 2020, Deposed in support of Cisco in the Centriptal vs. Cisco case. Civil Action No. 2:18-cv-00094-HCM-LRL.
16. May 2020, Testified in support of Cisco in the Centriptal vs. Cisco case. Civil Action No. 2:18-cv-00094-HCM-LRL.

17. Jan 2021, Deposed in support of Droplets in the Droplets vs. Yahoo case. Civil Action No. 12-CV-03733-JST.
18. Jan 2021, Deposed in support of Droplets in the Droplets vs. Nordstrom case. Civil Action No. 12-CV-04049.
19. June 2021, Deposed in support of Sonos in the Sonos vs. Google case. Civil Action No. 6:20-cv-00881-ADA.
20. September 2021, Deposed in support of IBM in the IBM vs. Zillow case. Civil Action No. IPR2020-01655.
21. November 2021, Deposed in support of Apple in the Apple vs. Identity Security case. Civil Action No. 6:21-CV-460-ADA
22. January 2022, Deposed in support of IBM in the IBM vs. Chewy case. Civil Action No. 1:21-cv-01319-JSR.

Summary of Research Contributions

At Vanderbilt University I direct the Distributed Object Computing (DOC) Group at the Institute for Software Integrated Systems (ISIS), which is one of the leading research groups in the world on middleware platforms and MDE tools for DRE systems and mobile cloud computing platforms. Over the past several decades I have conducted and managed research projects on a range of topics, including patterns, optimization techniques, and empirical analyses of software frameworks that facilitate the development of quality of service (QoS)-enabled middleware and model-driven engineering (MDE) techniques/tools for distributed real-time and embedded (DRE) systems and mobile cloud computing apps running over wired/wireless networks and embedded system interconnects. The research methodology throughout my career has involved:

- *Creating* innovative middleware and MDE technologies technologies, such as design formalisms, QoS specification/enforcement techniques, end-to-end and cross-layer middleware optimizations, and automated tools for specifying, analyzing, and synthesizing dependable DRE software from higher-level domain-specific models.
- *Applying* these technologies in conjunction with colleagues in academia and industry to demonstrate and mature middleware and MDE technologies and tools in the context of production mission-critical DRE systems.
- *Amplifying* the adoption and transition of these technologies in both academia and industry via 625+ technical papers, 575+ tutorials and invited talks, millions of lines of popular open-source software, and scores of innovative face-to-face and online courses published and delivered to more than 300,000 students around the world.

The R&D efforts I have led have had a significant impact on academic research and commercial practice. For example, dozens of universities throughout the world use the middleware and MDE tools my DOC Group has developed as the basis for their research and teaching efforts. Moreover, the open-source middleware frameworks and MDE tools generated from projects I've led constitute some of the most successful examples of software R&D ever transitioned from research to industry, being widely used by thousands of companies and agencies worldwide in many domains for three decades. For example, the ACE and TAO middleware frameworks developed by the DOC Group are used by developers in thousands of companies (such as Boeing, Cisco, Ericsson, Kodak, Lockheed Martin, Lucent, Motorola, NASA/JPL, Nokia, Nortel, Raytheon, SAIC, Siemens, Sprint, and Telcordia) in a wide range of domains (such as telecom/datacom, healthcare, process automation, avionics, homeland security and defense, financial services, online gaming, social media, and distributed interactive simulation).

Teaching Contributions and Impact

I have taught scores of cutting-edge courses on topics relating to object-oriented design and programming, software patterns, middleware for distributed real-time and embedded systems, concurrent and networked programming with C++ and Java, and mobile cloud computing with Android. I received the 2015 Award for Excellence in Teaching by the Vanderbilt University School of Engineering. In addition, I've taught

10 popular MOOCs at Vanderbilt on topics related to pattern-oriented mobile cloud computing with Android to over 200,000 learners from around the world.

I recently created and co-taught one of the first cross-college University Courses at Vanderbilt on "Tackling Big Problems with Mobile Cloud Computing," where ten highly diverse teams consisting of 11 arts and science students and 44 computer science students were mentored by 11 faculty from the College of Arts and Sciences, the School of Nursing, the School of Law, the School of Medicine, the School of Engineering and Vanderbilt University Medical Center. The projects in this course addressed relevant, real-world problems involving mobile cloud computing technologies, including:

- Effectively engaging young people with chronic diseases and medical conditions, such as diabetes, asthma and obesity
- Creating "smarter" cities and sustainable energy platforms via an app-based transportation hub for Nashville, and remotely monitoring the safety and operations of novel sources of power, including solar, wind and natural gas, and
- Helping economically disadvantaged individuals bridge the digital divide to obtain better guidance on medical and legal matters.

Summary of Career Accomplishments

My career accomplishments include the following:

Publications and presentations. I have published 650+ works (127 journal papers, 195 conference papers, 5 books, 4 book-length reports, 3 edited book collections, 64 book chapters, 74 workshop papers, 13 short papers and posters, 75 trade magazine columns/articles, and 101 editorials and book forewords). My papers have appeared in the most selective journals (*e.g.*, ACM Transactions in Embedded Computing Systems, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Software Engineering, IEEE Transactions on Computing, IEEE Journal of Selected Areas of Communications, and ACM Transactions on Autonomous and Adaptive Systems) and conferences (*e.g.*, ACM SIGCOMM, ACM OOPSLA, IEEE INFOCOM, IEEE ICDCS, IEEE RTAS, ACM/IEEE Middleware, and the ACM/IEEE ICSE) in my field. I have also given 600+ invited lectures and tutorials world-wide.

Measures of scholarly impact. My publications have been cited 45,000+ times across a comprehensive spectrum of high-impact venues. My h-index is 87 and my i10 index is 401. These bibliometrics indicate the significant impact of my publications as a researcher in the field of Computing.

Funding. Since June 1995 I have been a PI or co-PI for grants, contracts, and gifts totaling more than $41 million dollars. I have been the sole PI for over $11.5 million dollars of this amount.

Graduate advising and training. During my academic career I have (co-)advised and graduated 19 doctoral students and over 25 masters students.

Professional service and leadership. I have engaged in the following professional service and leadership capacities during my career:

- Served as guest editor of 12 ACM, IEEE, and USENIX journals, and served as editor-in-chief of the C++ Report magazine.
- Served as general chair or program (co)-chair for 35 conferences, tutorial chair for 4 conferences, co-organized 14 workshops, and served on the program committees for over 245 ACM, IEEE, IFIP, USENIX, and OMG conferences.
- From 2013 to 2015 I served on the Advisory Board for the joint US Navy/Army Future Airborne Capability Environment (FACE).
- From 2013 to 2015 I served as co-lead of a task area on "Published Open Interfaces and Standards" for the US Navy's Open Systems Architecture initiative.
- From 2010 to 2014 I served a member of the Air Force Scientific Advisory Board, where I was the Vice Chair of a study on Cyber Situational Awareness for Air Force mission operations.
- From 2006 to 2011 I served as the Chief Technology Officer for the Software Engineering Institute at Carnegie Mellon University (2010 to 2011), Zircon Computing (2009 to 2010), and Prism Technologies (2006-2008), where I was responsible for directing the technical vision and strategic R&D investments.
- From 2000 to 2003 I served as a Program Manager at the DARPA Information Technology Office (ITO) and Information eXploitation Office (IXO) the Deputy Director for DARPA ITO, where I lead the national R&D effort on QoS-enabled middleware for DRE systems.

- From 2001 to 2003 I served as Co-chair for the Software Design and Productivity (SDP) Coordinating Group, which formulates the multi-agency research agenda in fundamental software design for the Federal government's Information Technology Research and Development (IT R&D) Program, which is the collaborative IT research effort of the major Federal science and technology agencies.

University service and leadership. I have engaged in the following service and leadership capacities at Vanderbilt University during the past two decades:

- **Associate Provost of Research**. I became the Associate Provost for Research at Vanderbilt University in July of 2018. In this capacity I am responsible for developing cohesive and sustainable information technology (IT) services to advance research and scholarship across Vanderbilt's ten schools and colleges, including scalable and secure storage, processing, and communication solutions; big data research cores and corerelated services, and NIST 800-171 compliant IT services. I am also responsible for overseeing Vanderbilt's new "liquid workforce" service that provides researchers with on-demand access to shared technology expertise to help them develop research IT solutions, especially with data-intensive workflows, while also enabling shared software developers to add value to multiple research programs throughout the university.
- **Data Sciences Initiatives**. I am deeply involved in Vanderbilt's initiatives on Data Science. Starting in August 2018, I became a founding Co-Director of the Data Science Institute at Vanderbilt. During the past year I also chaired the ad hoc committee on Big Data for the Vanderbilt University School of Engineering (VUSE) strategic planning process, as well as served on the Provost's Special Task Force on a trans-institutional Masters in Data Science and the Provost's Working Group on Data Science Visions, which sets the direction for trans-institutional Data Science research. I also created and led a presentation on "Big Data" for the Vanderbilt University Board of Trust in the spring of 2017 that helped initiate Vanderbilt's investment in the Data Science Institute.
- **Cross-College Teaching**. I am a leader in Vanderbilt University's forays into Cross-College teaching. For example, I served as a member of the Provost's Study Group on Cross College Teaching, which formulated the concept of "University Courses" that brings faculty together from multiple schools to actively engage students of diverse backgrounds and promote new and creative trans-institutional learning. I also created/taught one of the first University Courses on "Tackling Big Problems with Mobile Cloud Computing." Each semester since the fall of 2016 I've taught this course in a multidisciplinary environment where undergraduate and graduate students from multiple schools team with computer science students to address big questions, such as how mobile cloud computing technologies can engage young people with chronic diseases; change political discourse in the United States and around the world; and help economically disadvantaged individuals bridge the digital divide to obtain better guidance on nutrition and legal matters. I also spearheaded the effort to create a CS 1000 course on "the beauty and joy of computing" that is intended for non-CS majors at Vanderbilt University.
- **Digital Learning**. I play a significant role in Vanderbilt's digital learning initiatives, including teaching (1) the first Massive Open Online Course (MOOC) at Vanderbilt in 2013 on "Pattern-Oriented Software Architecture for Concurrent and Networked Systems," (2) the first trans-institutional MOOC Specialization (together with the University of Maryland, College Park) in 2014 on "Mobile Cloud Computing with Android," (3) a Coursera Specialization on "Android App Development" since the spring of 2016, and (4) the forthcoming online Computer Science professional master's degree being created in conjunction with 2U. I have also played a key role in formulating the Vanderbilt digital learning strategy as a member of the Advisory Committee for the Vanderbilt Institute for Digital Learning (VIDL), a member of the Vanderbilt Online Education Task Force, a member of the Chancellor's Social Media and the Internet committee, chair of the Schmidt Family Annual Educational Technologies Lectureship, and a member of the Provost's committee on Digital Literacy whose charter is to ensure that all Vanderbilt students learn computational thinking in their undergraduate experience.
- **Technology Entrepreneurship**. I have been highly engaged in entrepreneurship leadership at Vanderbilt over the past five years. In particular, I chaired the VUSE Technology Entrepreneurship Task Force and the Provost's Committee on the Vanderbilt Innovation Center, known as the Wond'ry (I also served as a member of the search committee for the first Director of the Wond'ry Innovation Center). I am one of the inaugural faculty mentors for the "Garage Program at the Wond'ry, where I mentor multi-disciplinary teams of undergraduate and graduate students to help

companies (such as Accenture and RGP) establish new lines of business, e.g., liquid workforce services for the oil and gas domain, supply chain risk management using blockchain technologies, etc. I also serve as the faculty advisor for the VandyApp, DataBrains, and BizTech student organizations, which teach software development skills, prepare students for technical job interviews, and foster a welcoming and diverse environment for high-tech entrepreneurship collaboration across campus.

- **EECS Department Leadership**. I served as the Associate Chair of the Electrical Engineering and Computer Science (EECS) department at Vanderbilt University from 2004 to July 2018. In this capacity I worked with the EECS Chair to provide intellectual leadership and assist in EE, CS, and CompE faculty hiring, curricular development, and course staffing. I also represented Vanderbilt at the bi-annual CRA "CS Chairs" meeting at Snowbird Utah since 2008. In the past several years I focused on innovative digital learning techniques (such as pre-recording material and/or recording lectures in class so students can listen/watch to them at their leisure to ensure they master the course material) to handle the surge in undergraduate CS enrollment without adversely affecting Vanderbilt's commitment to high quality education. I also spearheaded several initiatives to create a continuing education program focused on web development in partnership with Trilogy Education Services and a professional masters degree program in CS in conjunction with 2U.
- **Information Technology Infrastructure for Research**. Over the past two decades I've played a leadership role in the Vanderbilt University Information Technology (VUIT) planning and governance processes. In addition to my latest role as the Associate Provost for Research, I've also chaired the faculty committee on Academic Computing and Information Technology (ACIT), served as the VUSE point of contact for VUIT, the VUSE representative for the Research IT committee as a member of the VUIT faculty advisory committee, as well as served as a member of the Research Advisory Committee on Information Technology (RACIT), and a member of the Provost's Research IT Special Project Working Group, which focuses on supporting the research needs of all schools at Vanderbilt.

Appendix B

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Attorney Docket No. 11-1001-CON0115 (MBHB 14-1795-US3))

In the Application of: Arthur Coburn IV	)	Examiner: Oschta Montoya
Application No.: 14/628,952	)	Group Art Unit: 2421
Filing Date: Feb. 23, 2015	)	Confirmation No.: 6897
For: Networked Music Playback	)	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313

RESPONSE TO NON-FINAL OFFICE ACTION MAILED MAY 9, 2017

Responsive to the Non-Final Office Action mailed May 9, 2017, Applicant respectfully requests reconsideration of the application in view of the following remarks. Applicant generally authorizes the Office to charge any underpayment or credit any overpayment to Deposit Account No. 13-2490 and to treat this or any subsequent communication that requires an extension of time as incorporating a request for such an extension.

Remarks begin on page 2.

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REMARKS

I. Summary of the Office Action

Following the non-final Office Action mailed May 9, 2017, claims 1, 4-10, 13-19, and 21-29 stand rejected under 35 U.S.C. § 103 as being allegedly unpatentable over Togashi et al. (US PGPUB 2005/0235334) in view of Roberts et al. (US PGPUB 2012/0304233) in view of Zott et al. (US PGPUB 2009/0228919).

Claims 3, 12, and 20 stand rejected under 35 U.S.C. § 103 as being allegedly unpatentable over Togashi in view of Roberts in view of Millington (US PGPUB 2012/0192071).

Claims 2 and 11 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

II. Status of the Claims

Currently pending are claims 1-29, of which claims 1, 10 and 19 are independent and the remainder are dependent.

III. The Pending Office Action is Incomplete Under MPEP § 707.07(f)

In the previous Office Action dated February 7, 2017, claims 1, 10 and 19 were rejected under § 103 as allegedly being unpatentable over Togashi in view of Roberts. In a Response thereto filed on April 5, 2017, Applicants traversed the rejection via argument. In particular, Applicant's argued that Togashi in view of Roberts does not teach or suggest Applicant's previously-presented feature of "a control device" "causing ***one or more first cloud servers*** to add multimedia content to a local playback queue on the particular playback device" and "causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device ***retrieving the multimedia content from one or more second cloud servers of a streaming content service*** and playing back the retrieved multimedia content," as recited by Applicant's claim 1. Independent claims 10 and 19 recited analogous subject matter.

The outstanding Office Action states on page 2 that "Applicant's arguments with respect to claims 1-29 have been considered but are moot in view of the new grounds of rejection."

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Applicants understand that the "new ground(s)" indicated in the Office Action refer to Applicant's amendment of "wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at the one or more second cloud servers of the streaming content service."

However, the outstanding Office Action again rejected the above-referenced features of Applicant's claims 1, 10, and 19 under § 103 as allegedly being unpatentable over Togashi in view of Roberts without responding to the clear traversal presented in Applicants' previous Response filed April 5, 2017. This failure to answer the substance of Applicants' arguments renders the Office Action incomplete as to all matters, as is required by 37 C.F.R. § 1.104(b). Further, MPEP § 707.07(f) states that "[i]n order to provide a complete application file history and to enhance the clarity of the prosecution history record, an examiner must provide ***clear explanations of all actions*** taken by the examiner during prosecution of an application" (emphasis added). "Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant's argument and ***answer the substance of it***." (*Id.*, emphasis added). "The examiner must address all arguments which have not already been responded to in the statement of the rejection." (MPEP § 707.07(f), Examiner Note 1).

In the present case, the outstanding Office Action essentially repeated the rejections presented in the previous Office Action and failed to address Applicant's clear traversals. In fact, none of Applicant's arguments were specifically addressed in the outstanding Office Action. Further, failure to specifically respond to Applicant's arguments renders the Office Action arbitrary and capricious, and therefore invalid under the Administrative Procedure Act (5 U.S.C. § 706), a standard to which all Actions by the USPTO must adhere (see *Dickenson v. Zurko*, 527 U.S. 150 (1999)).

Applicants respectfully request that the Examiner address the substance of Applicants' arguments in the next Office Action.

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IV. Response to the Art Rejections

a. Response to § 103 Rejections of Claims 1, 10, and 19

Applicant respectfully submits that Togashi in view of Roberts in view of Zott does not teach or suggest "one or more ***first*** cloud servers," "one or more ***second*** cloud servers" and their claimed features with respect to the "control device," as recited by Applicant's claims 1, 15, and 20.[1] As described in detail below, Togashi in view of Roberts in view of Zott suggests, at most, using a single type of cloud server (*i.e.*, a cloud content server) rather than disclosing the two different sets of servers recited by Applicant. Moreover, Togashi discloses a different technique than claimed by Applicant for transferring playback of multimedia content between devices.

Togashi discloses that servers 1 and 2 have identical configurations (Togashi, [0110]) and that either of servers 1 or 2 can act as a source of audio data (*i.e.*, a server) for any of the audio reproduction apparatus 3 to 5. (Togashi, [0129]). Togashi also discloses that during a transfer of audio content reproduction from a first audio reproduction apparatus to a second audio reproduction apparatus, the first audio reproduction apparatus can request the server that is providing the content to change the destination of transmitted audio from the first audio reproduction apparatus to the second audio reproduction apparatus. (Togashi, [0146]). In other words, to transfer audio content reproduction from a first audio reproduction apparatus to a second audio reproduction apparatus, Togashi teaches the first audio reproduction apparatus requesting the content server to change the destination of the audio content.

However, some streaming content service providers might not configure their content servers to be responsive to such requests. Unlike Togashi's system, Applicant's claimed technique does not require a content server to be responsive to requests from the audio reproduction device to transfer audio content reproduction. Instead of requesting a content server to change the destination of the audio content, Applicant's claims recite a different technique for transferring playback of multimedia content between devices. In particular, Applicant's claims recite "causing ***one or more first cloud servers*** to add the multimedia content to a local playback queue on the particular playback device" by "adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at the ***one or more second cloud servers*** of a streaming content service."

[1] Applicant notes that emphasis is added to certain terms throughout.

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In other words, Applicant's technique splits functionality between two sets of servers. The one or more first cloud servers "add the multimedia content to a local playback queue" while the "one or more second cloud servers" provide the multimedia content. Togashi does not teach splitting functionality in this manner. Instead, Togashi teaches that its two servers (servers 1 and 2) are identical content servers and that an audio reproduction device will request the server that is providing audio content to change the destination of the audio content during a transfer of audio content reproduction. (Togashi, [0110], [0129], [0146]).

This deficiency is not remedied by Roberts. Roberts discloses cloud servers that "provide[] one or more media content services for access by an end user." (Roberts, [0024]). While Roberts discloses "cloud-based media content services," Roberts does not disclose splitting functionality across two different sets of servers in the manner claimed by Applicant. In particular, Roberts does not disclose "one or more first cloud servers" providing the multimedia content and "one or more second cloud servers" "adding the multimedia content to a local playback queue." At most, Togashi in view of Roberts discloses that during a transfer of audio content reproduction from a first audio reproduction apparatus to a second audio reproduction apparatus, the first audio reproduction apparatus can request a server that is providing the content (which could be a cloud-based content server) to change the destination of transmitted audio from the first audio reproduction apparatus to the second audio reproduction apparatus. (Togashi, [0146]; Roberts, [0024]).

Zott does not remedy the above-identified deficiency of Togashi in view of Roberts. Zott discloses that a "media link URL may be added to a playlist." (Zott, [0027]). However, Zott does not teach "***one or more second cloud servers*** adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at the one or more first cloud servers of the streaming content service," as recited by Applicant's independent claims. Instead, Zott teaches that a "media link URL may be added to the playlist ***by dragging the URL from a browser address bar and dropping it*** in the playlist application window (when the playlist is a resident program) or alternately the Web playlist function interface browser window." (Zott, [0027]).

In view of the foregoing, Applicant requests that the art rejections of claims 1, 10, and 19 be withdrawn.

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b. Response to § 103 Rejections of Dependent Claims

Applicant submits that the pending § 103 rejections of Applicant's dependent claims should be withdrawn as well for at least the reason that they depend upon one of independent claims 1, 10 and 19, which are allowable over the cited art of record.

V. Conclusion

Applicant submits that claims 1-29 are in condition for allowance. Applicant does not acquiesce in any assertion by the Examiner that is not expressly addressed by these remarks. The Examiner is encouraged to call the undersigned at (312) 913-2128 with questions or comments for discussion.

Respectfully submitted,
McDONNELL BOEHNEN HULBERT & BERGHOFF LLP

Date: August 28, 2017

By: /Benjamin M. Urban/
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Appendix C

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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

GOOGLE LLC, Plaintiff v. SONOS, INC., Defendant.	CASE NO. 3:20-cv-06754-WHA **GOOGLE LLC'S PRELIMINARY CLAIM CONSTRUCTIONS AND EVIDENCE PURSUANT TO PATENT LOCAL RULE 4-2**

Pursuant to Patent Local Rule 4-2 and the Court's Scheduling Order, Plaintiff Google, LLC ("Google") hereby provides its preliminary constructions for each term of the Patents-in-Suit proposed by the parties for claim construction, references from the specification and prosecution history that support Google's proposed constructions, and its designation of supporting extrinsic evidence. Accompanying this disclosure, Google is producing documents labeled with production numbers GOOG-SONOSNDCA-00056802 - GOOG-SONOSNDCA-00056943.

Prior to transfer, Sonos requested that the Texas court proceed with claim construction. At Sonos's request, the Texas court construed a number of the terms in the asserted patents. *See Sonos, Inc. v. Google LLC*, Case No. Case 6:20-cv-00881-ADA, W.D. Tex., August 10, 2021 Markman Hearing Transcript, Dkt. No. 106. Sonos requested the jurisdiction of the Texas court over Google's objection and received claim constructions that it should not be allowed to relitigate. Thus, in the instant case and in view of Sonos's litigation positions, the prior constructions and indefiniteness rulings provided by the Texas court continue to apply, and Sonos's attempts to re-litigate these constructions is improper. *Snyders Heart Valve LLC v. St. Jude Medical*, 2020 WL 1445835, *4 & *6-*7 (D. Minn. 2020) (adopting "the Texas court's prior constructions" because "under law-of-the-case/reconsideration principles, 'as a rule,' courts should be 'loathe' to revisit prior decisions of its own or of a coordinate court in the same case" unless the decisions were "clearly erroneous" or the parties "present new evidence."). By including these terms in the charts below, Google does not agree that the prior construction should be the subject of reconsideration. To the extent the Court permits Sonos to reconsider the prior claim construction order, Google reserves its right to supplement its claim construction positions with additional terms.

Google has not yet completed discovery, its investigation is ongoing, and it has not yet considered Defendant's proposed claim constructions and supporting material. Accordingly, Google provides this list based on its current knowledge and reserves the right to amend, modify, or supplement this list as necessary based on further discovery and understanding of Google's positions. For example, Google anticipates that this list may be modified after considering Defendant's proposed claim constructions and supporting evidence, participating in conferences

with Defendant regarding the same, and the parties' prospective efforts in preparing a Joint Claim Construction and Pre-Hearing Statement pursuant to Patent Local Rule 4-3. Google reserves the right to rely on any of the supporting material identified by Defendant, and to provide expert testimony for any terms that Sonos indicated it intends to provide expert testimony for. Google also reserves the right to modify this list based on other discovery in the matter and newly learned information.

[Proposed Constructions Follow]

U.S. Patent No. 10,779,033 ("the '033 patent")

Claim Term	By	Google Proposed Construction	Specification and Prosecution History[1]	Extrinsic Support
"playback device"[2]	Sonos	Plain and ordinary meaning; no construction necessary at this time	'033 at 2:8-19; 3:15-23; 3:36-39; 3:46-60; 4:40-48; 7:29-9:13; 12:16-27; 12:16-13:56; 15:47-53	• IEEE 100 *The Authoritative Dictionary of IEEE Standards Terms*, 7th Edition (2000) **playback** (1) A term used to denote reproduction of a recording. (EEC/PE) [119] (2) *See also:* reversible execution. (C) 610.12-1990 (3) To output data or text for review purposes. *Synonyms:* playout; printout. (C) 610.10-1994w • Dictionary of Multimedia Terms and Acronyms, 4th Edition (2005) **playback** (n.) The realization of recorded images or sound on any kind of audio or video equipment.
"data network"	Sonos	Plain and ordinary meaning; no construction necessary at this time	'033 at 1:22-24; 4:6-20; 5:20-65; 7:4-21; 7:44-57.	• McGraw-Hill Dictionary of Scientific and Technical Terms, Sixth Edition (2003) **analog data** [COMPUT SCI] Data represented in a continuous form, as contrasted with digital data having discrete values. { 'an·əl,äg 'dad·ə }

[1] For all of the asserted patents, where Google identifies a figure from the specification of a given patent-in-suit, it also identifies the associated text describing said figure and reserves the right to rely on it. Where Google identifies a portion of the specification referencing a figure, it also identifies the figure and reserves the right to rely on it.

[2] For terms already briefed in the Western District of Texas, Google reserves its rights to rely on any evidence or argument raised during the prior set of briefing.

				data [COMPUT SCI] **1.** General term for numbers, letters, symbols, and analog quantities that serve as input for computer processing. **2.** Any representations of characters or analog quantities to which meaning, if not information, may be assigned. [SCI TECH] Numerical or qualitative values derived from scientific experiments. { 'dad·ə, 'dād·ə, *or* 'dăd·ə } **digital data** [COMPUT SCI] Data that are electromagnetically stored in the form of discrete digits. { 'dij·əd·əl 'dad·ə } **packet** [BIOL] A cluster of organisms in the form of a cube resulting from cell division in three planes. [COMMUN] A short section of data of fixed length that is transmitted as a unit. [PHYS] *See* wave packet. { 'pak·ət } • Dictionary of Computer and Internet Terms, Ninth Edition (2006) **data** information. The word was originally the plural of *datum*, which means "a single fact," but it is now often used as a collective singular. Data processing is the act of using data for making calculations or decisions. *Usage note:* This usage came and went. • Hargrave's Communications Dictionary (2001) **data** A representation of a collection of facts, concepts, instructions, or information to which meaning has been assigned. The representation may be analog, digital, or any symbolic form suitable for storage, communication, interpretation, or processing by human or automatic means. "Data" is the plural of the Latin *datum*, meaning one item of information. To be correct, a single item should be called a datum and more than one should be called *data*, i.e., "one datum is . . ." and "two *data are* . . ."

network (1) A collection of generally passive, electronic components (e.g., resistors, capacitors, and inductors) interconnected in some way that performs a specific function; usually limited in scope (e.g., simulation of a transmission line or pulse shaping). (2) A collection of two or more autonomous information sources and sinks interconnected by one or more communication links. The components of a network include:

- Nodes (computers, printers, network interface cards[—NICs], etc.).
- Connection elements (cabling, wiring centers, optical fibers, switching systems, etc.).

The interconnecting link(s) may either be temporary (as with the dial-up telephone network) or permanent, such as with cables. The data passing through the interconnecting link is examined for errors, in contrast with a *multiprocessor system* wherein the data is accepted "at face value."

- Topology (physical and logical):
  - Physical topology describes how nodes are wired or interconnected. (Various topologies include the bus, ring, and star networks.)
  - Logical topology describes how network packets are treated. For example, a logical ring may be created on a physical star network by addressing a token packet sequentially to each node.
- Auxiliary components (peripheral devices, safety devices, and tools).
- Network operating system (NOS) and workstation software.

Networks are often classified according to their geographic extent or according to the transmission protocol used. Some examples of voice and/or data networks include the public switched telephone network (PSTN), integrated services digital network (ISDN), Ethernet (local area network), and the Internet (a world wide computer network). See also *network classifications*.

- Comprehensive Dictionary of Electrical Engineering, Second Edition (2005)

analog data data represented in a continuous form with respect to continuous time, as contrasted with digital data represented in a discrete (discontinuous) form in a sequence of time instant.

analog signal a signal represented in a continuous form with respect to continuous time, as contrasted with digital signal represented in a discrete (discontinuous) form in a sequence of time instant. *See also* analog data.

				local area network a network of computers and connection devices (such as switches and routers) that are located on a single site. The connections are direct cables (such as UTP or optical fiber) rather than telecommunication lines. The computer network in a university campus is typically a local area network. • Newton's Telecom Dictionary, Nineteenth Edition (2003) **Analog Signal** A signal in the form of a continuous wave varying in step with the actual transmitted information; attempts to transmit an exact replica of the inputted signal down a communications channel. See Analog and all the various definitions starting with Analog. **Data** This is AT&T Bell Labs' definition: "A representation of facts, concepts or instructions in a formalized manner, suitable for communication, interpretation or processing." Typically anything other than voice. **Digital Signal** A discontinuous signal. One whose state consists of discrete elements, representing very specific information. When viewed on an oscilloscope, a digital signal is "squared." This compares with an analog signal which typically looks more like a sine wave, i.e. curvy. Usually amplitude is represented at discrete time intervals with a digital value. • Modern Dictionary of Electronics, Seventh Edition (1999) **analog data** — 1. A physical representation of information such that the representation bears an exact relationship to the original information. The electrical signals on a telephone channel are an analog data representation of the original voice. 2. Data represented in a continuous form, as contrasted with digital data represented in a discrete (discontinuous) form. Analog data is usually represented by physical variables, such as voltage, resistance, rotation, etc.

				data — 1. A general term used to denote any or all numbers, letters, symbols, or facts that refer to or describe an object, idea, condition, situation, or other factors. It connotes basic elements of information that can be processed or produced by a computer. Sometimes *data* is considered to be expressible only in numerical form, but *information* is not so limited. 2. A general term for any type of information. 3. Inputs in the form of a character string that may have significance beyond their numerical meaning. 4. Any representations, such as characters or analog quantities, to which meaning might be assigned. **digital data** — 1. Data represented in discrete, discontinuous form, as contrasted with analog data represented in continuous form. Digital data is usually represented by means of coded characters (e.g., numbers, signs, symbols, etc.). 2. Any data that is expressed in digits. The term usually implies the use of binary digits. • Webster's New World Telecom Dictionary (2008) **packet** **1.** In the generic sense, referring to the manner in which data are organized into discrete units for transmission and switching through a data network. The data unit can be known as a block, frame, cell, or packet, depending on the protocol specifics. The packet comprises a header, payload, and sometimes a trailer, again depending on protocol specifics. The packet can be a user packet containing user data, or a signaling and control packet for various network monitoring, alerting and alarming, maintenance, and other administrative purposes. The payload can be a complete message, a fragment or segment of a message, or an aggregation of bits or bytes that form a short portion of a long data stream associated with a voice or video call. See also *bit*, *block*, *byte*, *cell*, *data stream*, *fragment*, *frame*, *header*, *message*, *payload*, *protocol*, *segment*, and *trailer*. **2.** In a technology-specific sense, a packet is a data unit in an internetwork, such as the Internet or other packet-switched network in which routers interconnect networks and subnetworks to exchange traffic between nodes. In terms of the OSI Reference Model, a packet is defined in Layer 3, the Network Layer. Blocks, cells, and frames are defined in Layer 2, the Data Link Layer, and have local significance, only. See also *block*, *cell*, *datagram*, *Data Link Layer*, *frame*, *Internet*, *Network Layer*, *OSI Reference Model*, *packet switch*, and *router*. • Webster's New World Computer Dictionary, 10th Edition (2003)

				packet In networking, a unit of data of a fixed size—not exceeding the network's maximum transmission unit (MTU) size—that has been prepared for transmission over a packet-switching network. Each packet contains a header that indicates its origin and its destination. Synonymous with datagram. See *packet-switching network*. • Packet Broadband Network Handbook, McGraw-Hill (2004), (excerpts) **8.1 Introduction** A local area network is a high-speed data network that covers a relatively small geographic area. It typically connects workstations, personal computers, printers, servers, and other end-user devices, which are collectively also known as *data terminal equipment*. The common applications of LAN include shared access to devices and applications, file exchange between connected users, and communication between users via electronic mail and others. LANs are also private data networks, because they belong to an organization and are used to carry data traffic as opposed to voice traffic. This section provides a brief introduction to LAN history, standards, protocol stacks, topologies, and devices. **8.1.1 LAN History and Standards** LAN is a type of broadband packet access network that carries the packet data traffic of an organization. LAN interconnects the end users of an organization to an outside public data network such as the Internet. The basis of LAN technologies and standards was defined in the late 1970s and early 1980s. LAN technologies really emerged with the Internet itself, and the first widely deployed LAN technology, Ethernet, is almost as old as the Internet itself. The overwhelming majority of the deployed LANs are Ethernet. IEEE 802, a branch of the International Institute of Electrical and Electronics Engineers (IEEE), is responsible for most of the LAN standards. These standards have also been adopted by other standards organization such as ANSI and ISO. The major LAN standards are listed in Table 8-1. • Okhravi et al., *Data Diodes in Support of Trustworthy Cyber Infrastructure*

				• Vorontsove et al., *Development of unidirectional data diode system in the secure environment*, Workshop on computer science and information technologies 19th CSIT 2017, Germany, Baden- Baden, 2017 • U.S. Patent No. 6,081,907 to Witty et al. (Data Delivery System and Method for Delivering Data And Redundant Information Over a Unidirectional Network) • Declaration of Kyriakakis dated June 1, 2021 (Case No. 6:20-cv-00881-ADA, Dkt 64-12) • *See also* "local area network" below.

U.S. Patent No. 9,967,615 ("the '615 patent")

Claim Term	Proposed By	Google Proposed Construction	Specification and Prosecution History	Extrinsic Support
"local playback queue on the particular playback device" (Claims 13, 20-21, 25)	Google	A data structure stored within the particular playback device that maintains an ordered list of two or more multimedia items for playback in the listed order	'615 patent, 12:31-67; 16:20-31; 16:52-62; 16:62-17:4; Figs. 4, 7, 9-11.	• Google may introduce expert testimony from Dr. Kyriakakis regarding the ordinary meaning of this term to a person of ordinary skill in the art in the context of the intrinsic record, including the opinion that Google's proposed construction is consistent with that meaning. • Sonos 2014 provisional application 62/007,906 • U.S. Patent No. 9,674,587 e.g. at 2:52-67, 14:4-16:47, Fig. 4 • Microsoft Computer Dictionary, 5th Edition (2002) **queue**[1] *n.* A multi-element data structure from which (by strict definition) elements can be removed only in the same order in which they were inserted; that is, it follows a first in, first out (FIFO) constraint. There are also several types of queues in which removal is based on factors other than order of insertion—for example, some priority value assigned to each element. *See also* deque, element (definition 1). *Compare* stack. • Webster's New World Telecom Dictionary (2008)

				queue A list, string, or stack of things constructed so that items are added to one end and relieved from one end or the other. Generally speaking, items are added to one end, known as the tail, and relieved from the other end, known as the head. In the absence of some priority mechanism for purposes of establishing and maintaining quality-of-service (QoS) differentiation, items are relieved from the head of the queue in the order they entered the tail. This approach is known as *first-in-first-out* (FIFO). Incoming call centers employ automatic call distributors (ACDs) that queue incoming calls, serving them to agents as they become available. Fax servers can queue documents for transmission during non-prime time hours, when international calling costs are lowest. PBX systems commonly have the capability to queue outgoing calls for expensive long distance circuits. Switches and routers queue packets in buffers until internal resources **queue** 40 are available to process them or until bandwidth is available to forward them. Systems may support mul ple queues for different types of calls or packets. Priority mechanisms can cause a call or packet to mo up in the queue or even advance to the head of the queue in order that it can be served more quickly. S • The New Penguin Dictionary of Computing by Pountain (2001) **queue** A data structure with the property that the first element that can be removed is the first one that was put in. Hence a queue enables a number of items to wait for the occurrence of an event, or access to a rationed resource, while maintaining the strict order in which they arrived. See also FIFO, STACK. • Microsoft Encyclopedia of Networking (2000)

				queue A collection of items waiting to be processed in a specific order. Examples of queues in computer and networking technology are numerous and include the following: • A print queue, which consists of print jobs waiting to be sent to a print device • A messaging queue (on a mail server such as Microsoft Exchange Server), which consists of messages waiting to be sent • A backlog of packets waiting to be forwarded over a specific interface by a router • Information, function calls, or transactions sent by one application and forwarded to another by Microsoft Message Queue (MSMQ) Server in Microsoft Windows NT or Message Queuing in Windows 2000 • A collection of fax messages waiting to be processed and sent by a fax server • A series of system messages, such as key presses and mouse clicks, sent by applications to an operating system for processing • McGraw-Hill Dictionary of Scientific and Technical Terms, 6th Ed. (2002) **queue** [COMPUT SCI] **1.** A list of items waiting for attention in a computer system, generally ordered according to some criteria. **2.** A linear list whose elements are inserted and deleted in a first-in-first-out order. [IND ENG] *See* waiting line. { kyü }
"resource locators" (Claims 13, 16, 25)	Google	"address of a resource on the Internet"	'615 patent, 11:65-12:3, 12:53-61, 14:44-53, 14:62-15:17, 15:37-46, Claims 16, 20	• Google may introduce expert testimony from Dr. Kyriakakis regarding the ordinary meaning of this term to a person of ordinary skill in the art in the context of the intrinsic record, including the opinion that Google's proposed construction is consistent with that meaning. • Microsoft Computer Dictionary, Fifth Edition (2002)

				URL *n.* Acronym for **U**niform **R**esource **L**ocator. An address for a resource on the Internet. URLs are used by Web browsers to locate Internet resources. A URL specifies the protocol to be used in accessing the resource (such as http: for a World Wide Web page or ftp: for an FTP site), the name of the server on which the resource resides (such as //www.whitehouse.gov), and, optionally, the path to a resource (such as an HTML document or a file on that server). *See also* FTP[1] (definition 1), HTML, HTTP, path (definition 1), server (definition 2), virtual path (definition 1), Web browser. • A Dictionary of Computing, Sixth Edition (2008) **URL** (*or* **url**) *Abbrev. for* universal (or uniform) resource locator. The address system used on the Internet, for example, to specify the location of documents in the *World Wide Web. For instance, http://www.eit.com/web/www.guide/ 538 is the URL of a starting point for new Web users. *See also* URI. • Wiley Electrical and Electronics Engineering Dictionary, IEEE Press, 2004. **URL** Abbreviation of **U**niform **R**esource **L**ocator, or **U**niversal Resource Locator. An Internet address which directs a browser to a specific location where an Internet resource, such as a Web page or document, is located. For example in the following URL, *http://www.yipeeee.com/whoo.html*, **http** is the protocol, the ***www.yipeeee.com*** portion is the domain name, and ***whoo.html*** is a document named *whoo* created utilizing HTML.
"media particular	Google	Indefinite	N/A	Declaration of Kyriakakis dated June 1, 2021 (Case No. 6:20-cv-00881-

playback system" (Claim 15)[3]				ADA, Dkt 64-12)
"playback device"	Sonos	Plain and ordinary meaning; no construction necessary at this time	*See* '033 above	*See* '033 above
"local area network"	Sonos	Plain and ordinary meaning; no construction necessary at this time	'615 at 7:37-50; 10:56-11:5; 16:1-8; 2:51-3:13; 12:19-43; 13:41-59; 15:38-46; 17:12-20	• Dictionary of Multimedia Terms and Acronyms, 4th Edition (2005) **local area network** (LAN) (n.) Any physical network technology that operates at high speeds over short distances, such as several thousand yards. Technologies that play roles in a LAN include Ethernet, token ring, Asynchronous Transfer Mode (ATM), Fiber Distributed Data Interface (FDDI) II, 10BASE-T, and Systems Network Architecture (SNA). The system of cables and interfaces controlled by a communications protocol that connects microcomputers for sharing resources and peripherals is all part of the LAN. Connection is also possible with an infrared or wireless link. Compare *wide area network*. • Webster's New World Computer Dictionary, 10th Edition (2003)

[3] This term was found indefinite prior to transfer. By including this term, Google does not agree that the prior construction should be the subject of reconsideration.

LAN Acronym for local area network. A computer network that uses cables or radio signals to link two or more computers within a geographically limited area (generally one building or a group of buildings). The linked computers are called workstations. LANs are differentiated by their architecture (peer-to-peer or client/server), topology (bus, hierarchical, multipoint, point-to-point, ring, or star), protocols (standards for transferring data among the linked workstations), and media (for instance, coaxial, twisted-pair, and fiber optic). Peer-to-peer LANs are simple to implement using the built-in networking capabilities of computers running Microsoft Windows or Mac OS; such networks enable the linked computers to share expensive peripherals such as laser printers; client/server networks use a LAN server to make centralized resources (such as databases and applications) available to workstation users. Network protocols operate at differing layers; for example, Ethernet is a lower-layer protocol that defines the basic mechanisms by which data enters the network and travels to its destination; Ethernets can work with a variety of higher-level protocols, including AppleTalk, Common Internet File System (CIFS), and TCP/IP. See *AppleTalk*, *baseband*, *broadband*, *bus network*, *client/server*, *Ethernet*, *peer-to-peer network*, *ring network*, *star network*, *wireless LAN*.

- **Webster's New World Dictionary of Computer Terms, Eighth Edition (2000)**

LAN Acronym for local area network. A computer network that physically links two or more computers within a geographically limited area (generally one building or a group of buildings). The linked computers are called workstations. Peer-to-peer LANs enable the linked computers to share expensive peripherals such as laser printers; client/server networks use a LAN server to make resources (such as databases and applications) available to workstation users. Local area networks have a characteristic topology (such as bus, ring, or star) and implement

one or more networking protocols (such as AppleTalk, Ethernet, or TCP/IP). See *AppleTalk*, *baseband*, *broadband*, *bus network*, *client/server*, *Ethernet*, *multiuser system*, *NetWare*, *network operating system (NOS)*, *peer-to-peer network*, *ring network*, and *star network*.

- **Comprehensive Dictionary of Electrical Engineering, Second Edition (2005)**

local area network a network of computers and connection devices (such as switches and routers) that are located on a single site. The connections are direct cables (such as UTP or optical fiber) rather than telecommunication lines. The computer network in a university campus is typically a local area network.

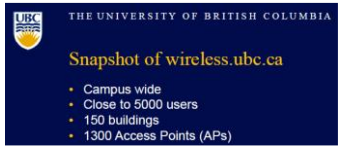
- **Newton's Telecom Dictionary, Nineteenth Edition (2003)**

Local Area Network LAN. A short distance data communications network (typically within a building or campus) used to link computers and peripheral devices (such as printers, CD-ROMs, modems) under some form of standard control. Older data communications networks used dumb terminals (devices with no computing power) to talk to distant computers. But the economics of computing changed with the invention of the personal computer which had "intelligence" and which was cheap. LANs were invented as an afterthought — after PCs — and were originally designed to let cheap PCs share peripherals — like laser printers — which were too expensive to dedicate to individual PCs. And as time went on, what LANs were used for got broader and broader. Today, LANs have four main advantages: 1. Anyone on the LAN can use any of the peripheral devices connected to the LAN. 2. Anyone on the LAN can access databases and programs running on client servers (super powerful PCs) attached to the LAN; and 3. Anyone on the LAN can send messages to and work jointly with others on the LAN. 4. While a LAN does not use common carrier circuits, it may have gateways and/or bridges to public telecommunications networks. See LAN Manager, Token Ring and Ethernet.

- **The Dictionary of Multimedia, Fourth Edition (2005)**

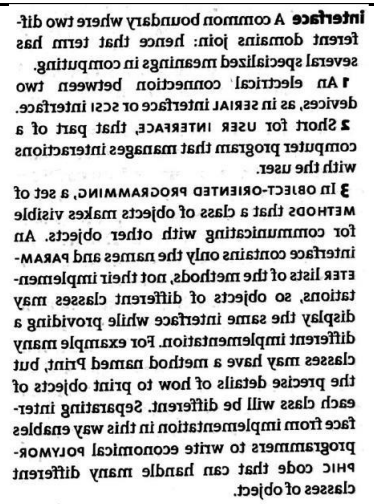
				local area network (LAN) (n.) Any physical network technology that operates at high speeds over short distances, such as several thousand yards. Technologies that play roles in a LAN include Ethernet, token ring, Asynchronous Transfer Mode (ATM), Fiber Distributed Data Interface (FDDI) II, 10BASE-T, and Systems Network Architecture (SNA). The system of cables and interfaces controlled by a communications protocol that connects microcomputers for sharing resources and peripherals is all part of the LAN. Connection is also possible with an infrared or wireless link. Compare *wide area network*. • **IEEE Standard for Local and Metropolitan Area Networks, Std. 802-2001 (2002)** 1.2 Key concepts The LANs described herein are distinguished from other types of data networks in that they are optimized f a moderate-sized geographic area, such as a single office building, a warehouse, or a campus. An IEEE 802 LAN is a peer-to-peer communication network that enables stations to communicate directly on point-to-point, or point-to-multipoint, basis without requiring them to communicate with any intermedia switching nodes. LAN communication takes place at moderate-to-high data rates, and with short trans delays, on the order of a few milliseconds or less. • **Microsoft Computer Dictionary, Fifth Edition (2002)**

				LAN *n.* Acronym for **local area network**. A group of computers and other devices dispersed over a relatively limited area and connected by a communications link that enables any device to interact with any other on the network. LANs commonly include PCs and shared resources such as laser printers and large hard disks. The devices on a LAN are known as nodes, and the nodes are connected by cables through which messages are transmitted. *See also* baseband network, broadband network, bus network, client/server architecture, collision detection, communications protocol, contention, CSMA/CD, network, peer-to-peer architecture, ring network, star network. *Compare* WAN. • **Computer & Internet Dictionary, Third Edition (1999)** **local-area network** A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a *wide-area network (WAN)*. Most LANs connect workstations and personal computers. Each *node*

				(individual computer) in a LAN has its own CPU with which it executes programs, but it is also able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with one another, by sending e-mail or engaging in chat sessions. There are many different types of LANs, *Ethernets* being the most common for PCs. Most Apple Macintosh networks are based on Apple's AppleTalk network system, which is built into Macintosh computers. The following characteristics differentiate one LAN from another: **topology:** The geometric arrangement of devices on the network. For example, devices can be arranged in a ring or in a straight line. **protocols:** The rules and encoding specifications for sending data. The protocols also determine whether the network uses a peer-to-peer or client/server architecture. **media:** Devices can be connected by twisted-pair wire, coaxial cables, or fiber optic cables. Some networks do without connecting media altogether, communicating instead via radio waves. LANs are capable of transmitting data at very fast rates, much faster than data can be transmitted over a telephone line; but the distances are limited, and there is also a limit on the number of computers that can be attached to a single LAN. ⇒ See also APPLETALK; ARCNET; BRIDGE; CLIENT/SERVER ARCHITECTURE; DCC; E-MAIL; ETHERNET; IEEE 802 STANDARDS; INTERNETWORKING; MAN; NETWARE; NETWORK; NETWORK INTERFACE CARD; NETWORK OPERATING SYSTEM; NODE; NOVELL; PEER-TO-PEER ARCHITECTURE; PERSONAL COMPUTER; PROTOCOL; SNMP; SWITCHING HUB; TOKEN BUS NETWORK; TOKEN-RING NETWORK; TOPOLOGY; TOPS; VLAN; WIDE-AREA NETWORK. • ***Deploying the World's Largest Campus 802.11b Network*, University of British Columbia** (November 11, 2003; available at http://www.ieee802.org/802_tutorials/03-6November/www.wireless.ubc.ca-IEEE-Nov2003.ppt)  *See also* "data network"
"network interface"	Sonos	Plain and ordinary meaning; no	'615 at 7:23-8:39; 9:49-59	• Dictionary of Computing, 6th edition (2010)

		construction necessary at this time		**network** /'netwɜ:k/ *noun* a system made of a number of points or circuits that are interconnected ■ *verb* to link points together in a network ○ *They run a system of networked micros.* 'Asante Technologies has expanded its range of Ethernet-to-LocalTalk converters with the release of AsantePrint 8, which connects up to eight LocalTalk printers, or other LocalTalk devices, to a high-speed Ethernet network.' [*Computing*] • The Computer Glossary, The Complete Illustrated Dictionary, 9th Edition (2001) **network** (1) An arrangement of objects that are interconnected. See *LAN*. (2) In communications, the transmission channels interconnecting all client and server stations as well as all supporting hardware and software. • Dictionary of Multimedia Terms and Acronyms, 4th Edition (2005) **network (n.)** A group of computers, peripherals, or other equipment connected to one another for the purpose of passing information and sharing resources. Networks can be local or remote. The topology of a network is the geographic arrangement of links and nodes, which may be arranged in the shape of a star, a tree, or a ring. • Dictionary of Computer and Internet Words (2001) **interface** 1. The devices, graphics, commands, and prompts that enable a computer to communicate with any other entity, such as a printer or the user. For example, the ports and connector are the interface between a computer and a printer. The interface that lets a user communicate with the computer is called a user interface. *See also* **user interface.** 2. *See* **port.**

				• Dictionary of Computer and Internet Terms, 8th Ed. (2003) **interface** the connection between two systems through which inform tion is exchanged. For example, in computer hardware, an interface an electrical connection of the proper type. In software, it is a standa format for exchanging data. The USER INTERFACE of a piece of softwa is the way it interacts with the human being who is using it. *See al* DATA COMMUNICATION; USER INTERFACE. • Computer and Internet Dictionary, 3rd Ed. (1999) **interface** *n* **1.** Something that connects two separate entities. For examp a *user interface* is the part of a program that connects the computer wi a human operator (user). There are also interfaces to connect programs, to connect devices, an to connect programs to devices. An interface can be a program or a de vice, such as an electrical connector. —*v* **2.** To communicate. For exam ple, two devices that can transmit data between each other are said to *terface with each other*. This use of the term is scorned by language purists because *interface* has historically been used as a noun. • Dictionary of Computer Science, Engineering, and Technology by Laplante (2001) **interface** (1) the boundary between a system and its environment, across which interaction occurs by the passing of information. (2) the externally visible features or charac teristics (of an object, use case, subroutine, etc.). This term is used in the languages supporting the distinction between interfaces and classes such as C++. • The New Penguin Dictionary of Computing by Pountain (2001)



interface A common boundary where two different domains join; hence that term has several specialized meanings in computing.
1 An electrical connection between two devices, as in SERIAL INTERFACE or SCSI INTERFACE.
2 Short for USER INTERFACE, that part of a computer program that manages interactions with the user.
3 In OBJECT-ORIENTED PROGRAMMING, a set of METHODS that a class of objects makes visible for communicating with other objects. An interface contains only the names and PARAMETER lists of the methods, not their implementations, so objects of different classes may display the same interface while providing a different implementation. For example many classes may have a method named Print, but the precise details of how to print objects of each class will be different. Separating interface from implementation in this way enables programmers to write economical POLYMORPHIC code that can handle many different classes of object.

- Data Telecommunications Dictionary by Peterson (1999)

interface A hardware connection, or logical connection or translation point. Interfaces are an intrinsic part of interconnected computers, peripherals, and networks. Almost every aspect of data and electrical connections in the telecommunications industry uses a different format or version of a format, and the interface is the point at which all these different hardware and software junctions come together. A cable, peripheral card, card slot, or chip socket are all types of interfaces, as are the images on the monitor and the sounds from a speaker.

- Understanding Networking Technology, 2nd Ed. (1999)

Interface ..... The boundary between two things, typically two programs, two pieces of hardware, a computer and its user, and a project manager and the customer.

"a media particular playback system"	Sonos	operation that controls a playback related function	Indefinite	Declaration of Kyriakakis dated June 1, 2021 (Case No. 6:20-cv-00881-ADA, Dkt 64-12)

U.S. Patent No. 10,848,885("the '885 patent")

Claim Term	Proposed By	Google Proposed Construction	Specification and Prosecution History	Extrinsic Support
"zone scene" (all asserted claims)	Google	zone: an area or areas with one or more playback devices zone scene: a group of two or more zones that are grouped according to a common theme by configuring the zones in a particular scene (e.g., morning, afternoon or garden)	'206 Patent, Reasons for Allowance, '966 Patent, Reasons for Allowance; see also '885 Patent Reasons for Allowance. '966 Patent, 2019-08-23 OA Response, e.g. at 18. '206 Patent, 8:19-42, 8:56-9:3, claim 8, Figs. 5A-C, 6. '206 Provisional App. at 13; 2:22-37.	• Declaration of Kyriakakis dated June 1, 2021 (Case No. 6:20-cv-00881-ADA, Dkt 64-12) • Google may introduce expert testimony from Dr. Kyriakakis regarding the ordinary meaning of this term to a person of ordinary skill in the art in the context of the intrinsic record, including the opinion that Google's proposed construction is consistent with that meaning. • Hargrave's Communications Dictionary (2001) **zone (1)** In an internetwork, a subset of nodes which, together, form a logical subdivision. A node can be part of one or more *zones*. A *zone* can encompass multiple networks and can cross network boundaries. (That is, it can apply to parts of several networks.) A *zone* may have a name associated with it that is used to simplify routing and service advertising. **(2)** In AppleTalk. A logical subset of nodes which together form a subdivision. It can have an associated name, and a node can be part of one or more zones. The zone name is used to simplify routing and service advertising. A zone can encompass multiple networks and can cross network boundaries (that is, apply to parts of several networks).
"zone player"	Sonos	Plain and ordinary meaning; no construction necessary at this time	'966 at 8:52-61; 5:57-6:8; 9:15-35	• Google may introduce expert testimony from Dr. Kyriakakis regarding the ordinary meaning of this term to a person of ordinary skill in the art in the context of the intrinsic record, including the opinion that Google's proposed construction is consistent with that meaning. • *See above* for "zone scene"

"data network"	Sonos	Plain and ordinary meaning; no construction necessary at this time	*See* '033 above	*See* '033 above

U.S. Patent No. 10,469,966 ("the '966 patent")

Claim Term	Proposed By	Google Proposed Construction	Specification and Prosecution History	Extrinsic Support
"zone scene" (all asserted claims)	Google	A previously saved grouping of zone players according to a common theme	*See* '885 above	*See* '885 above
"zone player"	Sonos	Plain and ordinary meaning; no construction necessary at this time	*See* '885 above	*See* '885 above

U.S. Patent No. 9,344,206 ("the '206 patent")

Claim Term	Proposed By	Google Proposed Construction	Specification and Prosecution History	Extrinsic Support
"zone configuration" / "group configuration" (all asserted claims)	Google	Indefinite	'966 at 8:52-61; 5:43-6:8; 9:15-35; Claim 1.	• Declaration of Kyriakakis dated June 1, 2021 (Case No. 6:20-cv-00881-ADA, Dkt 64-12) • *See above* for "zone scene"

Dated: January 10, 2022

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CERTIFICATE OF SERVICE

I certify that a true and correct copy of the above and foregoing document was served on counsel for plaintiff Sonos, Inc. via electronic delivery on January 10, 2022.

/s/ Nima Hefazi
Nima Hefazi